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(54) High frequency cable connector.

(57) An electrical connector (2) which is useable with coaxial or twinaxial shielded cables comprises an inner housing module (4) having a pair of electrical terminals (6) positioned therein for electrical connection with a signal conductor of the coaxial or twinaxial cable. The housing module (4) is insertable within a shield member (70) to form a shielded subassembly (88). A grounding spring clip (90) is positioned intermediate the two shielded sub assemblies (88), thereby commoning the adjacent shield members (70), and at the same time providing contact portions for receiving pins (120, 122) of a mating pin field.

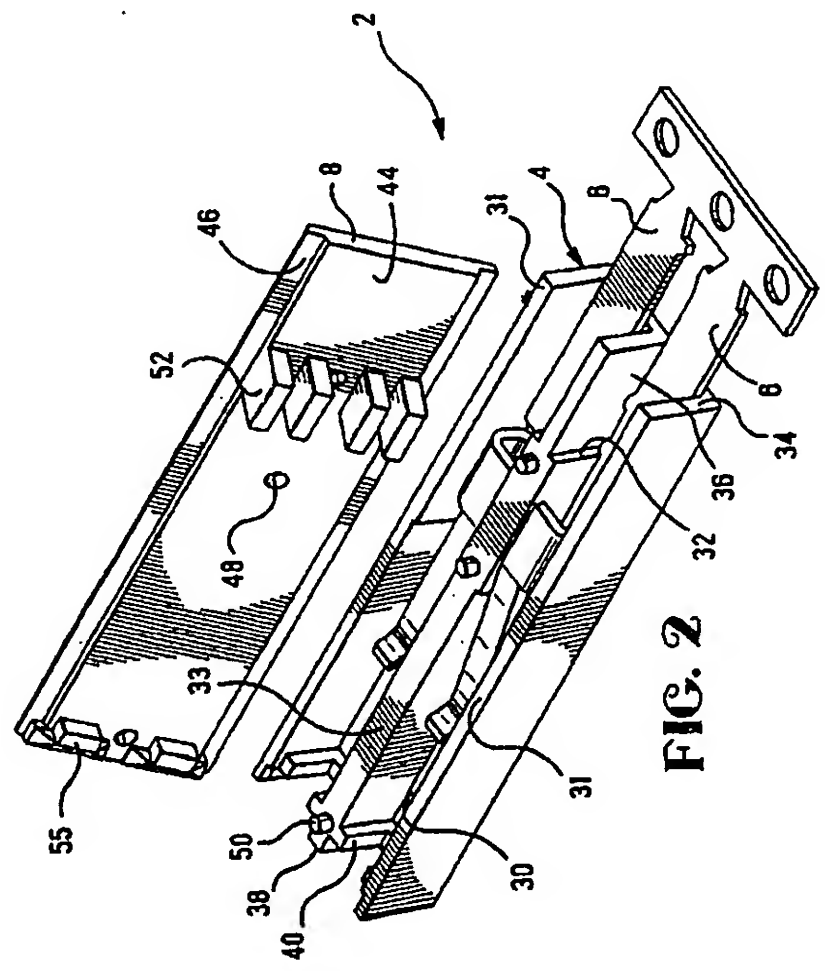

FIG. 2

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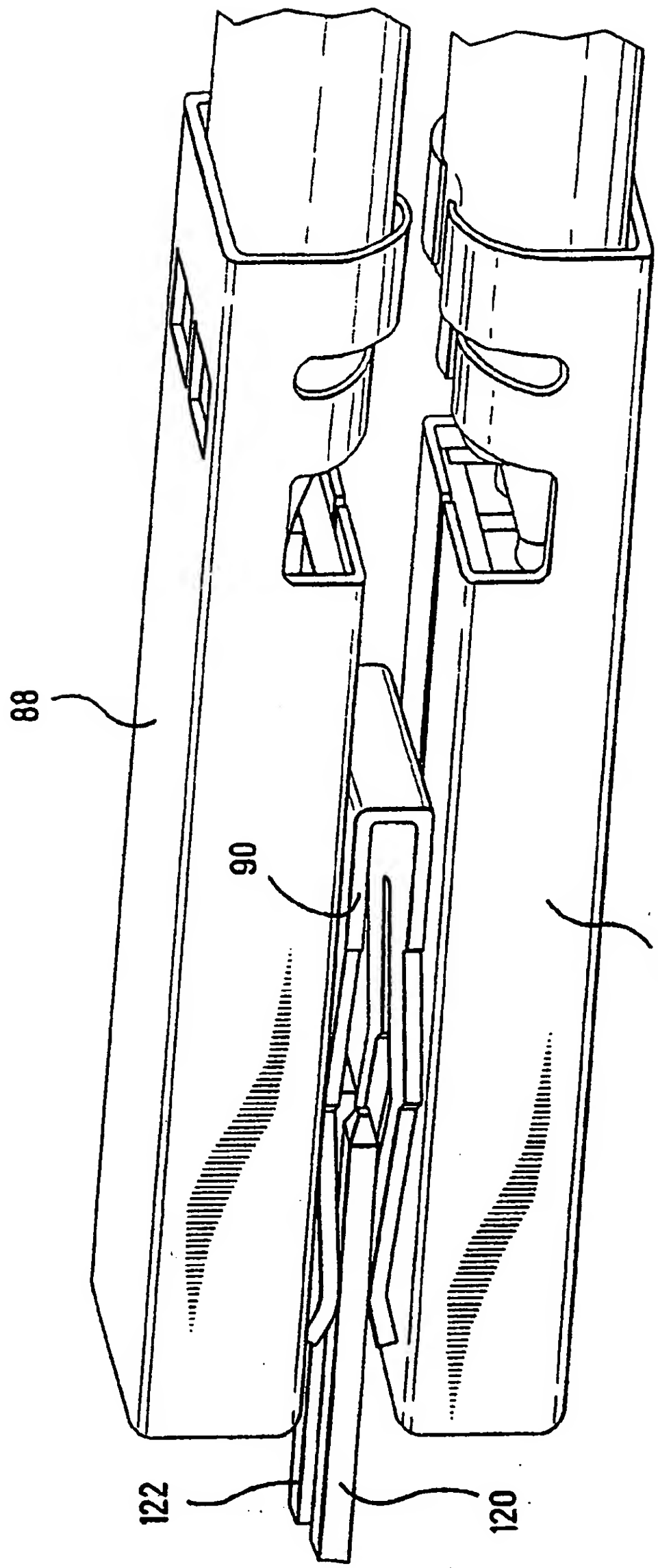

FIG. 7

The invention is directed to a high frequency electrical connector for a twin axial or a coaxial cable.

In the application of high frequency electrical connectors, it is important to entirely shield the signal contacts. However this often results in a complicated design or otherwise large connector system resulting in a large quantity of overall space required.

One shielded coaxial connector system is shown in European Patent Application O 446 980 where a shielded coaxial contact surrounds a dielectric body where the shield is electrically grounded to a shield of an electrical cable. The outer shield includes contact members formed integrally therewith for making contact with a mating pin or with an adjacent shield of an adjacent contact.

One of the difficulties that arises with this type of design is that the customer is responsible for terminating the electrical conductor of the shielded cable as well as the braid of the shielded cable to the connector terminals and subsequently installing the terminals in an associated housing. Assembly equipment varies from customer to customer and it is difficult to monitor the quality of the connections being made as well as the handling of the terminals during the installation process such that it is common to have damaged shield contacts on the outer periphery of this shield member which may prevent mating of the electrical pins in the mating connector, or otherwise prevent an electrical connection being made between the ground pin and the connector shield.

It is an object of the invention to provide a high density electrical connector for use with coaxial or twinaxial cable connectors, where the connector has an outer shield which can be electrically connected to a ground pin field in a mating connector.

It is a further object of the invention to provide an easy connector assembly process, while at the same time, provide an assembly where the ground contacts of the shield member are not damaged.

It is a further object of the invention to provide an electrical connector which is shielded and which includes a grounding contact for mating interconnection with another connector.

The objects of the invention were accomplished by providing a high density shielded electrical connector comprising at least two inner insulating housings separately surrounded by an outer shielding member, and having inner signal contacts, the outer shielding members being common together by way of a grounding spring clip which also defines a mating contact in the same direction as that of said signal contacts.

Embodiments of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is an isometric view showing two stamped and formed electrical terminals for use in the connector assembly;

Figure 2 is an isometric view showing the terminals of Figure 1 positioned within a lower housing portion with an upper housing portion poised for receipt over the lower housing portion;

Figure 3 is a view showing the cover portion in place with a twinaxial cable prepared for connection to the terminals of Figure 1;

Figure 4 is an isometric view from the opposite end of the housing as shown in Figure 3;

Figure 5 is an isometric view of an outer shield portion which is receivable over the housing depicted in Figure 4;

Figure 6 shows the housing of Figure 3 positioned within the outer shielding shell of Figure 5;

Figure 7 is a perspective view showing a ground terminal placed medially between two adjacent outer shielding shells which commons the two shells;

Figure 8 is an upper plan view of the commoning contact shown in Figure 7;

Figure 9 shows a side view of the contact as shown Figure 8;

Figure 10 shows an isometric view of the assembled connector;

Figure 11 shows an isometric view of a second embodiment of twinaxial cable connector;

Figure 12 shows an assembled view of the detail of the cable connector shown in Figure 11;

Figure 13 shows an upper plan view of the inner housing part of the cable connector of Figure 12;

Figure 14 shows a side view of the housing part shown in Figure 13;

Figure 15 shows an end view of the housing part of either of Figures 13 or 14;

Figure 16 shows an upper plan view of the cover part for use with the housing part of Figures 13-15;

Figure 17 shows a side plan view of the cover part for use with the housing part of Figure 16;

Figure 18 is an end view of the cover part shown in Figure 17;

Figure 19 shows an upper plan view of the signal terminal;

Figure 20 shows a side plan view of the terminal of Figure 19;

Figure 21 is a top plan view of the outer shield member;

Figure 22 is a cross sectional view through lines 12-12 of Figure 21;

Figure 23 is an end view of a shield member of Figure 21;

Figure 24 is an upper plan view of the shield contact for use with the shield member;

Figure 25 is an upper plan view of the shield member with the terminal positioned centrally of the shield member;

Figure 26 is a cross sectional view through lines 26-26 of Figure 25;

Figure 27 is an end view of the left hand side of the assembly of Figure 25;
Figure 28 is an upper plan view of the shield member of Figure 25 showing the housings positioned within the shield member;
Figure 29 is an upper plan view of the connector of Figure 28 showing an overmoulded rear housing part less the twinax cables;
Figure 30 shows a total cable assembly with the cables inmoulded;
Figure 31 shows a side plan view of the connector assembly of Figure 30; and
Figure 32 shows an end view of the assembly shown in Figure 31.

With reference first to Figure 2, a connector subassembly is shown generally at 2 comprised of an insulating housing portion 4, a pair of electrical terminals 6 and a cover portion 8.

With respect now to Figure 1, the terminal pairs are shown as a stamped and formed set of electrical terminals having base portions 10 forming rear wire receiving surfaces 12 and forward contact portions 14. The contact portions are formed by two contact arms 16 and 18 where the contact arm 18 extends forwardly from the base portion 10 while contact arm 16 is folded over about an integral tab portion 20 to place the contact arms one above the other. The contact arms are radiused at their front edges for example at 22, 24 to form lead-in sections for a mating tab in a mating connector. The terminal pair 6 include a strengthening bar 26 integrally formed between the two base portions 10 for rigidity purposes, but is stamped away prior to insertion in the housing.

With respect again to Figure 2, the housing member 4 includes two side by side channel-like openings 30 for receiving the terminals 6 therein. The housings include a reduced thickness portion at 32 which receives the retaining barbs 27 located along the side edges of the base portions 10, thereby holding the terminals in position within the housing. It should be appreciated that the channel-like openings open through the rear face 34 of the connector housing through openings 36. The housing 4 further includes a front mating face 38 providing pin receiving openings at 40 for receiving the pins of a mating electrical connector (not shown herein).

With reference still to Figure 2, the cover member includes an inner surface 44 having recessed edges 46 profiled for receipt on top edges of the side walls 31. Alignment of the cover member 8 with the housing member 4 is insured by cooperating apertures 48 in the cover part which cooperate with a plurality of studs 50 along the separating rib 33 of the housing portion. Furthermore, retention of the terminals 6 within the housing is insured by way of locking bars 52 which extend downwardly from the inner surface 44 of the cover member 8, and when the cover is in th fully closed position, are locked behind the contact arms 16. The forward end of the cover 8 includes wall portions 55 which cooperate with the openings 40 to form a closed pin-receiving opening. As shown in Figures 3 and 4, the cover member 8 is shown in the closed position with a raised section 58 extending above the upper surface 60 of the cover portion 8.

As shown best in Figure 3, the connector 2 has the terminal platform portions 6 extending outwardly of the housing 4 profiled for receiving the conductors 61 of a twinax cable 62. The cable 62 includes an outer insulating jacket 64 which is stripped partially to expose the conductive shield 66, while the insulation 68 of the individual insulated conductors 61 is stripped to expose the conductors 61, such that they are positioned on top of the platforms 6, where they can be soldered or otherwise welded in place.

With respect now to Figure 5, an outer shield member is shown generally at 70, which is stamped and formed from a flat sheet of metal material, to include a base portion shown at 72 having folded up sidewalls 74 and folded over split cover parts 76 having an axial seam at 78. Intermediate the cover parts 76 and formed by way of the seam 78 is a rectangular opening at 80 which is profiled to receive the raised section 58 of the cover part 8. Extending integrally from the sidewalls 74 are crimp portions 82 profiled for crimping to the braid 66 of the twinax cable 62. Also extending integrally from the side walls 74 are strain relief crimp arms 84 profiled to crimp around the outer jack portion 64 of the twinax connector. With respect now to Figure 6, the assembly shown in Figure 4 is insertable through a rear entry portion of the shield member 70, to the position shown in Figure 6. In the preferred embodiment of the invention the side walls 74 are overstamped such that upon insertion of the housing member 4, the seam 78 is slightly opened such that edges 89 of the opening 80 are in contact with the raised portion 58. As shown in Figure 6, the shield arms 82 are shown in position to be crimped to the ground shield portion 66 of the cable 62 while the strain relief 84 are profiled to grip the outer jacket 64.

With respect now to Figure 7, two shielded housings are shown at 88 spaced apart from one another and disposed in a parallel manner. A grounding spring clip 90 is positioned intermediate the two shielded housings 88 whereby the outer shields of the two shielded connectors 88 are commoned together.

With respect to Figures 8 and 9, the grounding spring clip 90 is shown as a stamped and formed U-shaped member formed from upper and lower plate portions 91 and 92 (Figure 9) stamped about a bight portion 94. The plate portions 91 and 92 are stamped into individual contact arms 96 and 98 having individual contact portions 100 and 102 extending forwardly therefrom. The contact portions 100 and 102 are spaced apart by a dimension of 2mm such that the two contact portions can connect pins on a 2mm grid

pattern. As shown best in Figure 9, the contact arm portions 96, 98 and 100, 102 are formed to project outwardly at 104, 106 to form contact portions to common the adjacent shield members, as shown in Figure 7. The contact arms 100 and 102 are constricted at the front portion to form contact surfaces 108 and 110 for mating with a complementary pin field. This is shown best in Figure 7 where pins 120 and 122 are shown in a spaced apart manner and are profiled to be received within the contacts formed at 108 and 110.

With respect now to Figure 10 an outer housing module is shown at 130 including channels 132 and 134 which are profiled for receiving side by side shielded modules. The housing 130 includes an opening intermediate the openings 132 and 134 for receiving the grounding spring clip therethrough which can be seated in a permanent position. Thus the shielded connector members 88 can be insertable and removable into and out of the channels 132, 134. In this manner, the outer housing 130 together with the installed grounding spring clip 90 can be shipped to the customer while the housing 4, cover 8 and terminals 6 can be assembled in a configuration shown in Figure 3, and the end user can assemble the cable 62 to the connector 2, later assemble the ground shield 70 and install the shielded subassemblies 88 within the housing 130 into contact with the intermediate spring grounding clip 90. While not specifically shown, the housing 130 would include a front face 140 having apertures in alignment with the openings 40 such that the mating pins can be received within the connector housing 130 and into contact with the contact portions 22, 24, (Figure 1).

With reference now to Figure 11, a second embodiment of the invention will be described. A shielded connector is shown generally at 202 comprising an inner housing part 204 having terminals 206 positioned therein and having and upper cover part 208 enclosing the terminal and the inner housing 204. An outer shield member is shown generally at 210 having a centrally disposed shield contact 212 positioned within a central recess 214 formed by the outer shield member 210. In the preferred embodiment of the invention, the connector is profiled for terminating a twinax cable shown generally at 216 comprising an outer insulative cover 218, an inner shield at 220, a signal conductor at 222 and a centrally disposed drain wire 224.

With reference now to Figures 13 through 15, the preferred embodiment of the inner housing 204 is shown in greater detail as including a front mating face 230, side walls 232 and an end wall 234. A rear wire terminating section is shown at 236 including channels at 238 which open into cavities at 240 which are defined by opposed side walls 242 and 244 and a recessed platform surface at 246. The side walls 244 are defined by a central upstanding platform portion at 250 which has a rear surface 252 which is recessed from the end wall 244. The housing 204 further comprises forward terminal receiving passageways at 255 which include pin receiving openings at 256 which open into the passageways 255 where each passageway 255 includes side wall surfaces 257, 258 and 259, on one side thereof and side surfaces 260 which extend forwardly and terminate within recess portions shown at 262. As shown best in Figure 14, the housing 204 includes a major top surface shown at 265 and a lower surface shown at 266. Aligning posts 268 extend upwardly from the major surfaces 265 and could be formed in a multitude of ways, for example with two side by side lugs 268 as shown in Figure 13 or as three in line lugs as shown in Figure 11.

The top cover part 208 is shown best in Figures 16 through 18 as including an inner surface at 270 having apertures 272 therein which match the lugs 268 on the housing portion 204.

As best shown in Figures 19 and 20, the signal contact 206 is shown as including a beam portion 280 having a transversely situated contact pad 282 thereon, the beam portion 280 extending forwardly through a right angled section 284 and a further beam portion 286 extending forwardly, a cantilever beam portion is shown at 288 which disposes a contact portion at 290 towards a free end portion 292. It should be appreciated that two such contacts 206 are positioned in one single housing 204, although these terminals are not identical, they are mirror images of one another.

As best shown now in Figures 21 through 23, an outer shield member is shown at 300, which is formed of a unitary piece of metal material, and is formed with a base wall at 302 whereby the base material is formed at right angles thereby forming side walls 304 and further folded over to form top coverparts at 306. The top cover parts are folded downwardly towards the base section having two inner side walls at 308 thereby forming two shielded enclosures at 310. The inner side wall portions 308 include folded over tab portions 312 and 314, where the tab portions 314 are interrupted by an opening 316 which overlies an opening 318 in the base portion. Intermediate the tab members 312 and 314, a nest 320 is formed for a ground contact as will be described herein.

With respect now to Figure 24, a ground contact is shown at 330 including a lower base portion 332 having folded up side edges 334 which form cantilever beam sections 336 forwardly to form a contact at 338.

With respect now to Figures 25 through 27, the shield contact 330 is shown disposed within the shield member 210 within the cavity 214 defined between adjacent inner side walls 318 of the shield. As shown best in Figure 26, the lower base section 332 is located in the nest section 320, positioned betwe n

the tab sections 312 and 314, and preferably the base section 332 is fastened to the base wall 302 of the shield member 210 by a welding, such as spot welding. As shown best in Figure 27 as positioned, the ground contact 330 has the contact section 338 disposed outwardly of the shield member whereas two shielding enclosures 310 flank either side of the terminal 330.

With respect now to Figures 11, 15 and 19, the terminals 206 are positioned within the housing 204 such that the beam portion 286 is positioned in the channels 238, which disposes the beam portion 280 adjacent to the outer walls 242, thereby disposing the contact pad 282 on the platform surface 246. This also disposes the beam portion 286 forwardly from the channels 238 such that the cantilever beam 288 extends obliquely across the passageway 255 such that the contact surface 290 is positioned adjacent to side wall portions 257 and 258, while the free end portion 292 is disposed behind the corner at 262. As shown in Figure 11, the housings 204 can then be closed by placing the cover 208 over the top and the housings 204 can be slidably received in the shielding enclosure 310. It should be noted that the top cover walls 306 of the shield member 300, are shorter than the base wall 302, as best shown in Figure 21, such that a portion of the base wall 302 is exposed from an upper side of the shield member 300. This positions the housing member within the shielding enclosure to a position shown in Figure 28, such that the contact pads 282 are accessible from a top portion of the shield member 300.

The connector is assembled by positioning the twinaxial cable 216, as prepared as shown in Figure 11, over the connector as assembled in Figure 28, with the signal contacts 222 positioned over adjacent contact pads 282, and with the drain wire 224 disposed between the contact pads. All three conductors can then be welded to their associated conductive part which electrically connects the twinax cable 216 to the connector assembly. As shown in Figure 29, an overmoulding web shown best at 350 can be positioned over the inner housing portions, and in particular over the rear section of the housing 204, to enclose the twinax cables 216 therein. As shown in Figure 29, the outer moulded web 350 includes a keyed opening at 352, which allows several housings to be placed one above the other as shown in Figure 12, with a pin or post positioned through aligned keyed openings 352 to retain them together. As shown in Figure 11, key members 360 can be attached to the housing members 204, which allow polarized connection to a mating connector.

Claims

1. A high density shielded electrical connector (2) comprising at least one insulating housing (44) having shielding (70) therearound, the connector (2) being characterized in that the connector (2) includes two inner insulating housings (4) separately surrounded by an outer shielding member (70), and having inner signal contacts (6) positioned in said housings (4), the outer shielding members (70) being commoned to a grounding spring clip (90), which defines a mating contact in the same direction as said signal contacts (6).

2. The connector of claim 1, characterized in that said outer shield member (70) is crimpable to shielded cable (62) to common the shielding member (70) with the outer shield (66) of the cable (62).

3. The connector of claims 1 or 2, characterized in that the housings (4) and shielding members (70) are positioned in an outer housings (130) having receiving openings (132,134) therein profiled to receive said shielding members (70), and said grounding spring clip (90) is positioned in said outer housing (130) intermediate said shielding members (70).

4. The connector of claim 3, characterized in that said grounding spring clip (90) is insertable into said outer housing (130), through a rear face thereof, and lockable therein.

5. The connector of either of claims 3 or 4, characterized in that said shielded housings (4) are insertable and removable into the outer housing (130), while said grounding spring clip (90) remains locked in the housing (4).

6. The connector of any of claims 1-5, characterized in that said grounding spring clip (90) is U-shaped in cross-section, including a constricted forward section (10) at the open end forming a contact portion for a pin (120), and an intermediate portion having outward projections (104,106), forming contact portions for contacting adjacent shield members (70).

7. The connector of any of claims 1-6 characterized in that said shielded connector includes a one piece shield member (300) folded from its ends over towards its center, thereby forming two shielded enclosures (310), and a centrally spaced apart section which carries the grounding spring clip (330) for contact with a ground pin.

8. The connector of claim 7, characterized in that the shield member (300) is folded so as to form two rectangular shield enclosures (310).

9. The connector of claim 7 or 8, characterized in that said shielded enclosures (310) receive therein, rectangular shaped housings (204), carrying said signal contacts (206).

10. The connector of any of claims 7-9, characterized in that the grounding spring clip (330) is a discrete member positioned between said two shielded enclosures (320)

11. The connector of any of claims 7-10, characterized in that the grounding spring clip (330) is welded to the outer shield (210).

12. The connector of any of claims 7-11, characterized in that said outer shield (210) comprises a lower base wall (302), two outer side walls (304), two top cover parts (306) which project inwardly towards a longitudinal center lug of the outer shield (210), and two spaced apart inner walls projecting downwardly to the base wall (302).

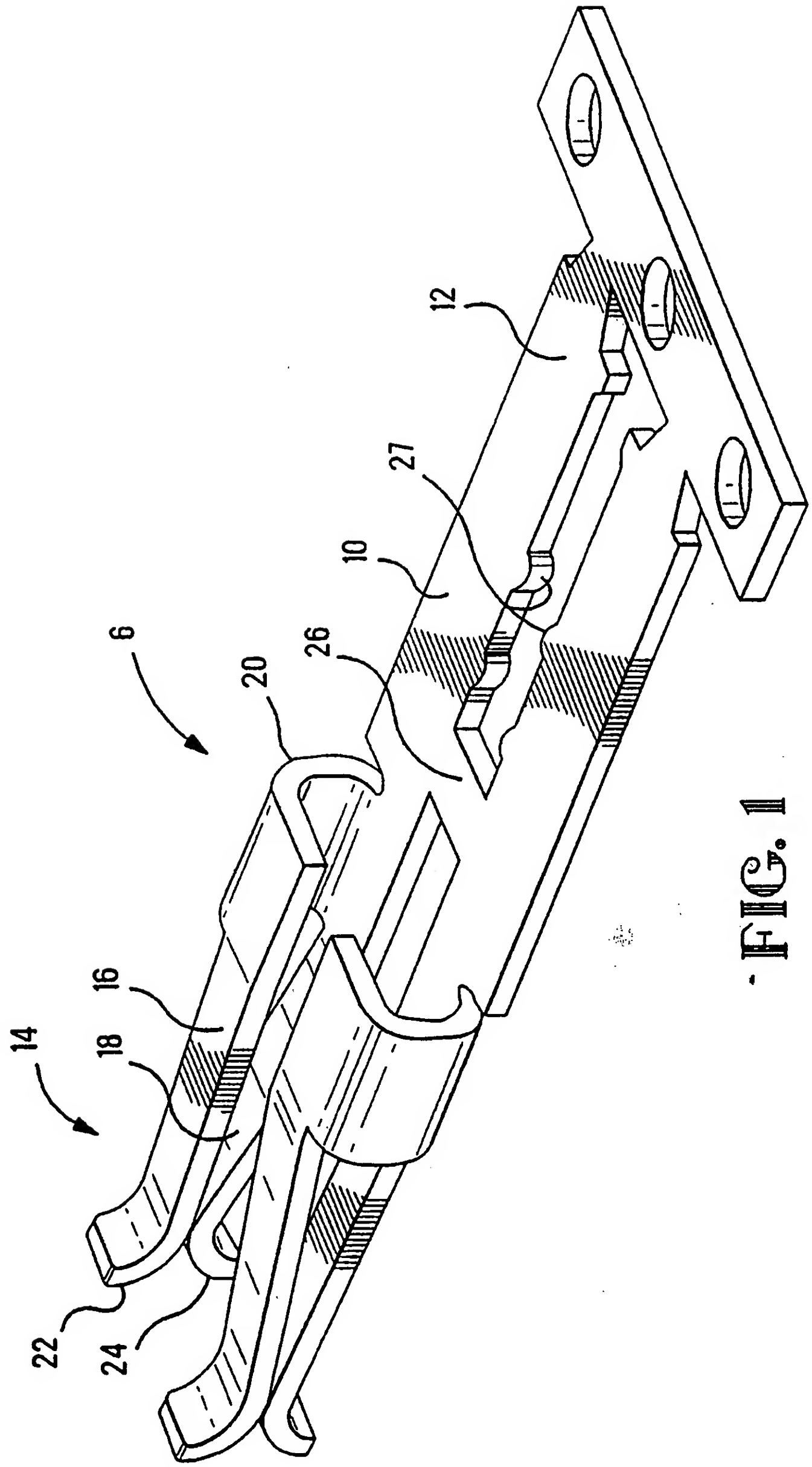

FIG. 1

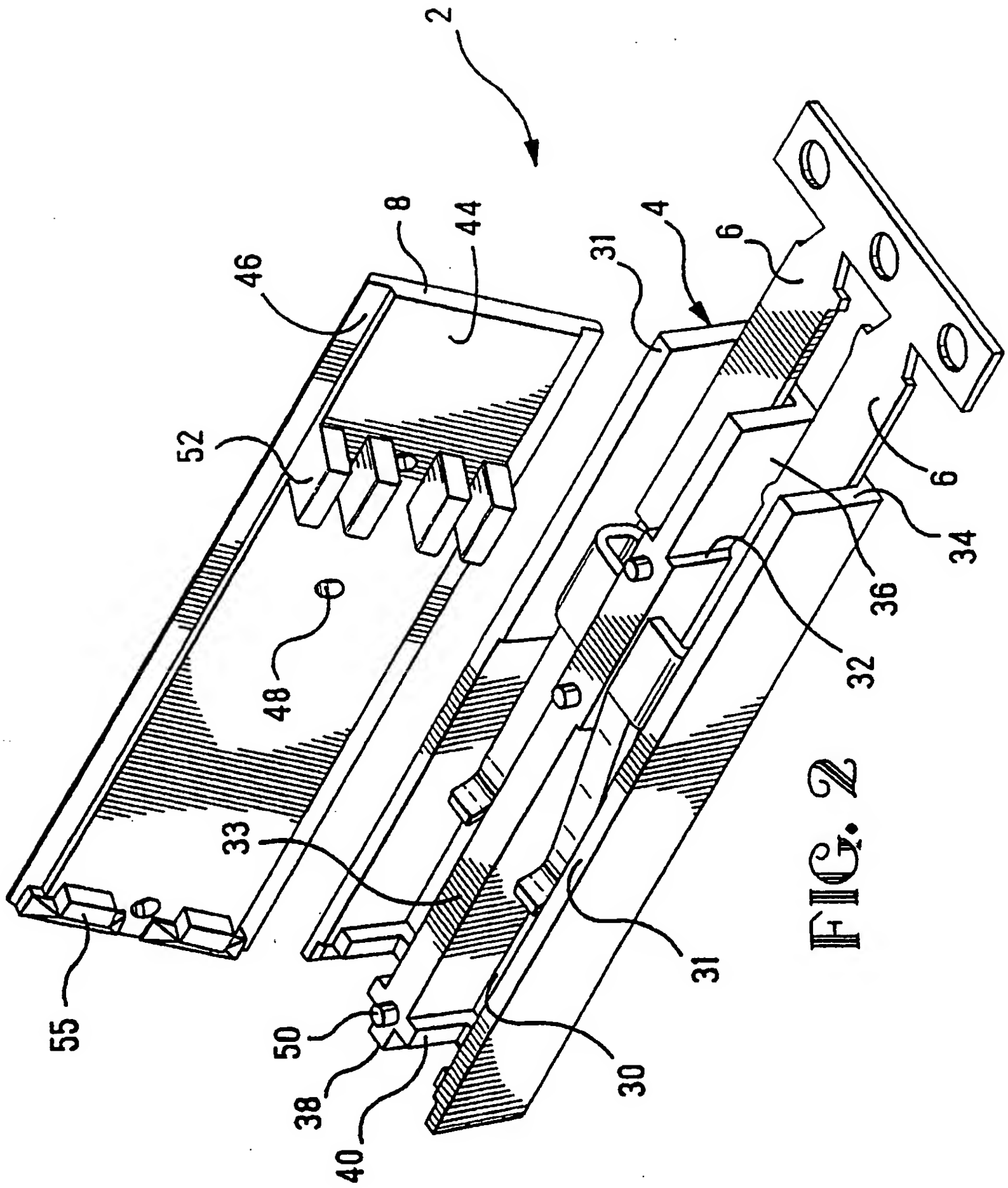

FIG. 2

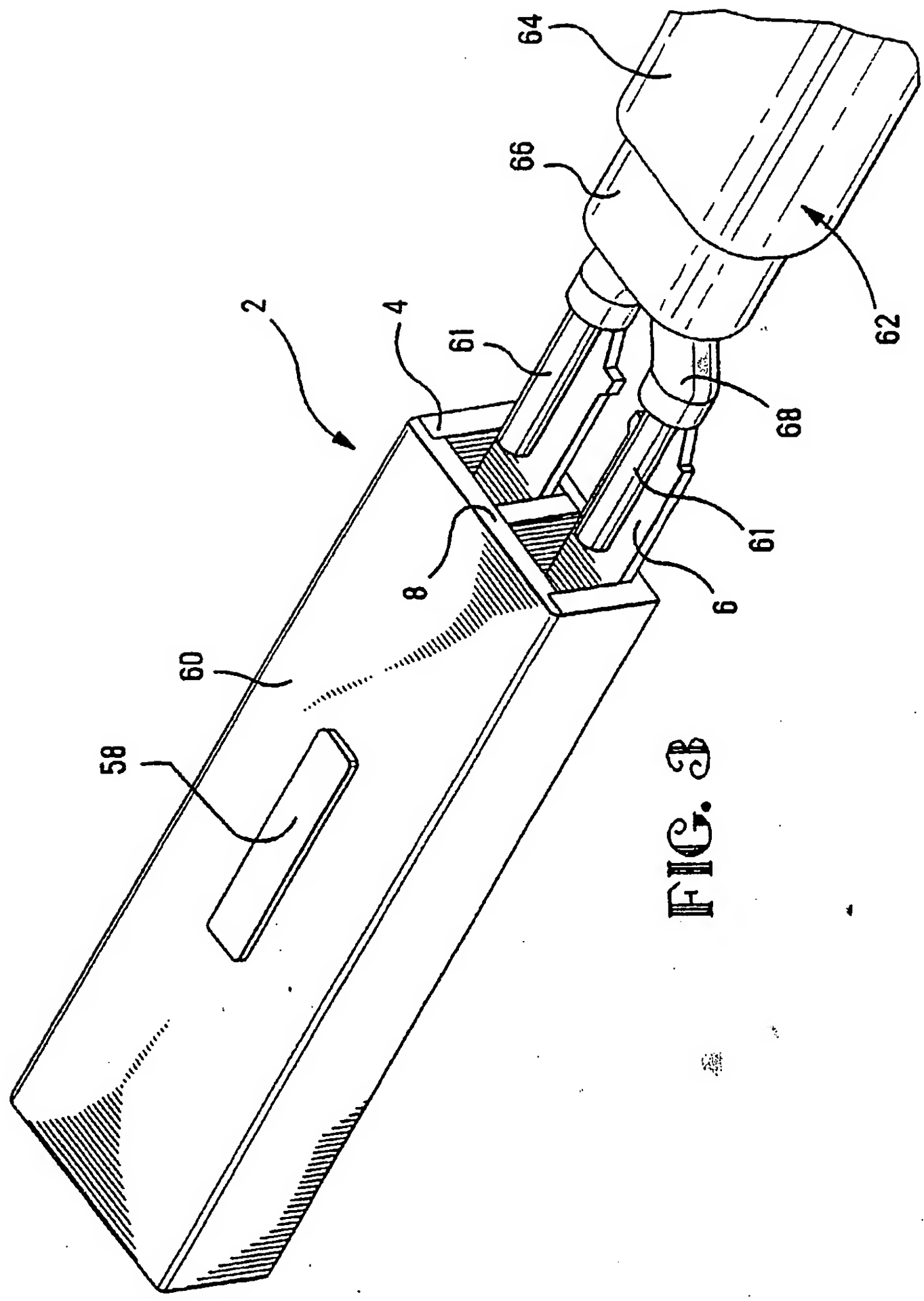

FIG. 3B

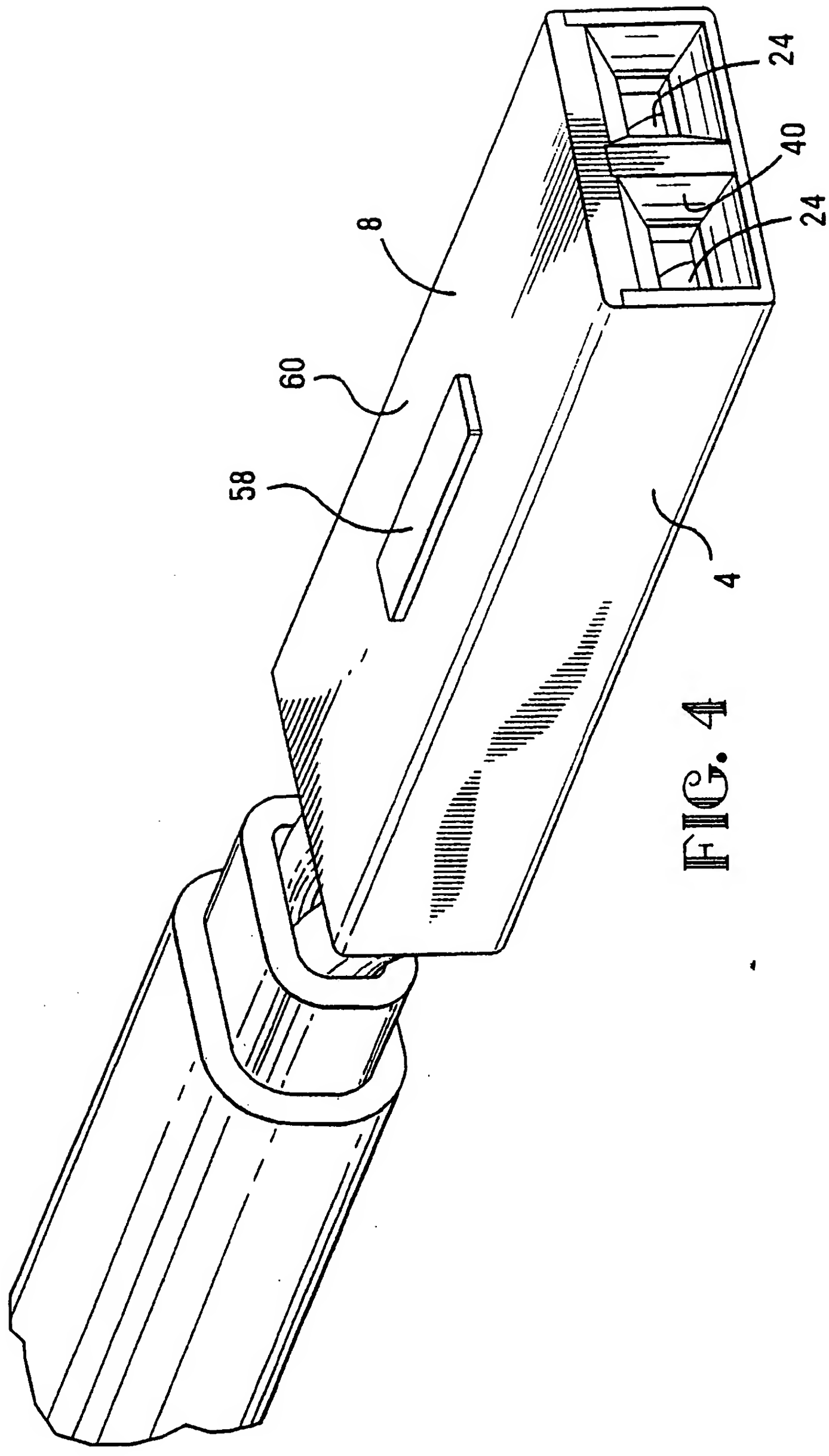

FIG. 4

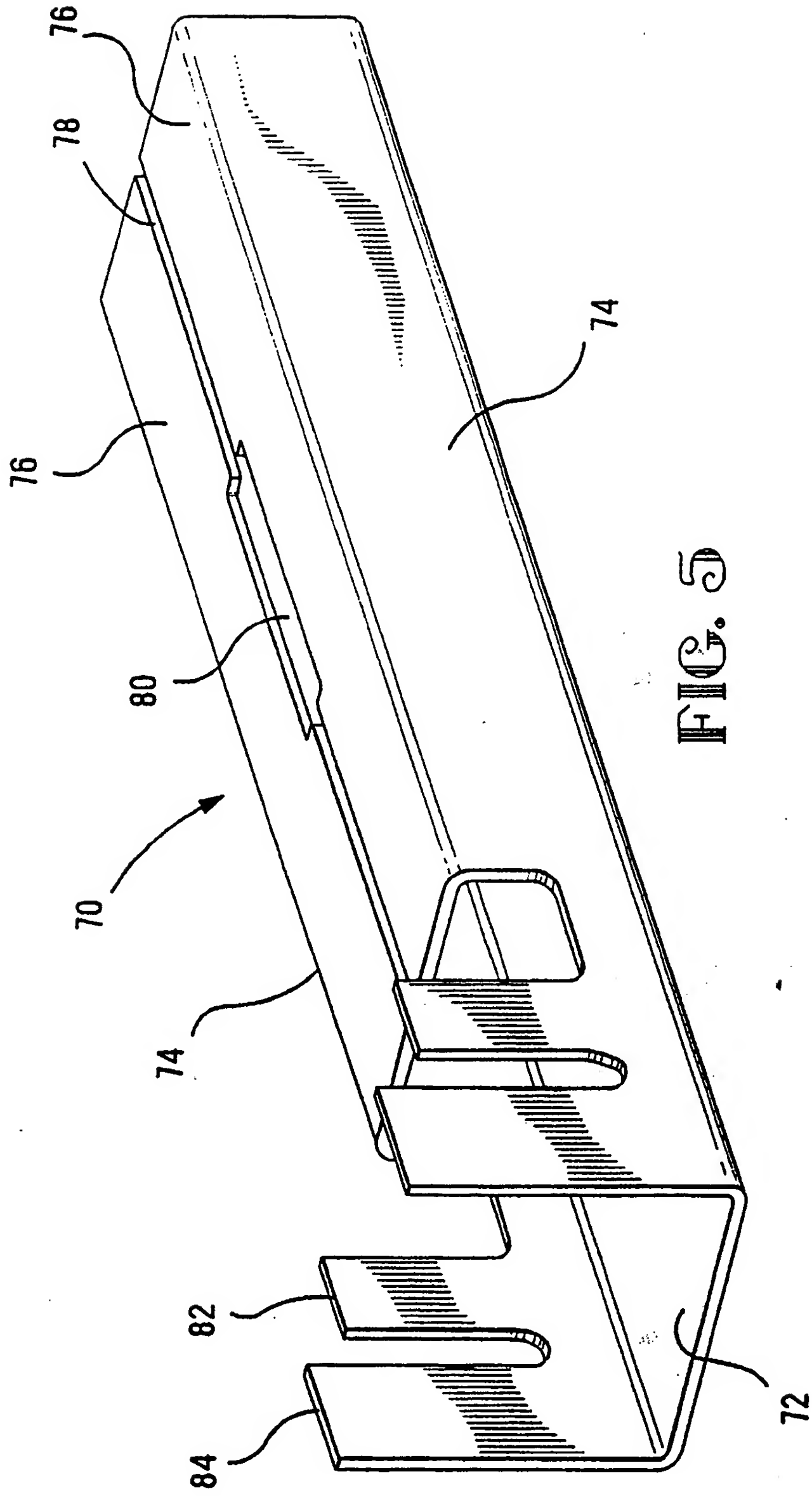

FIG. 5

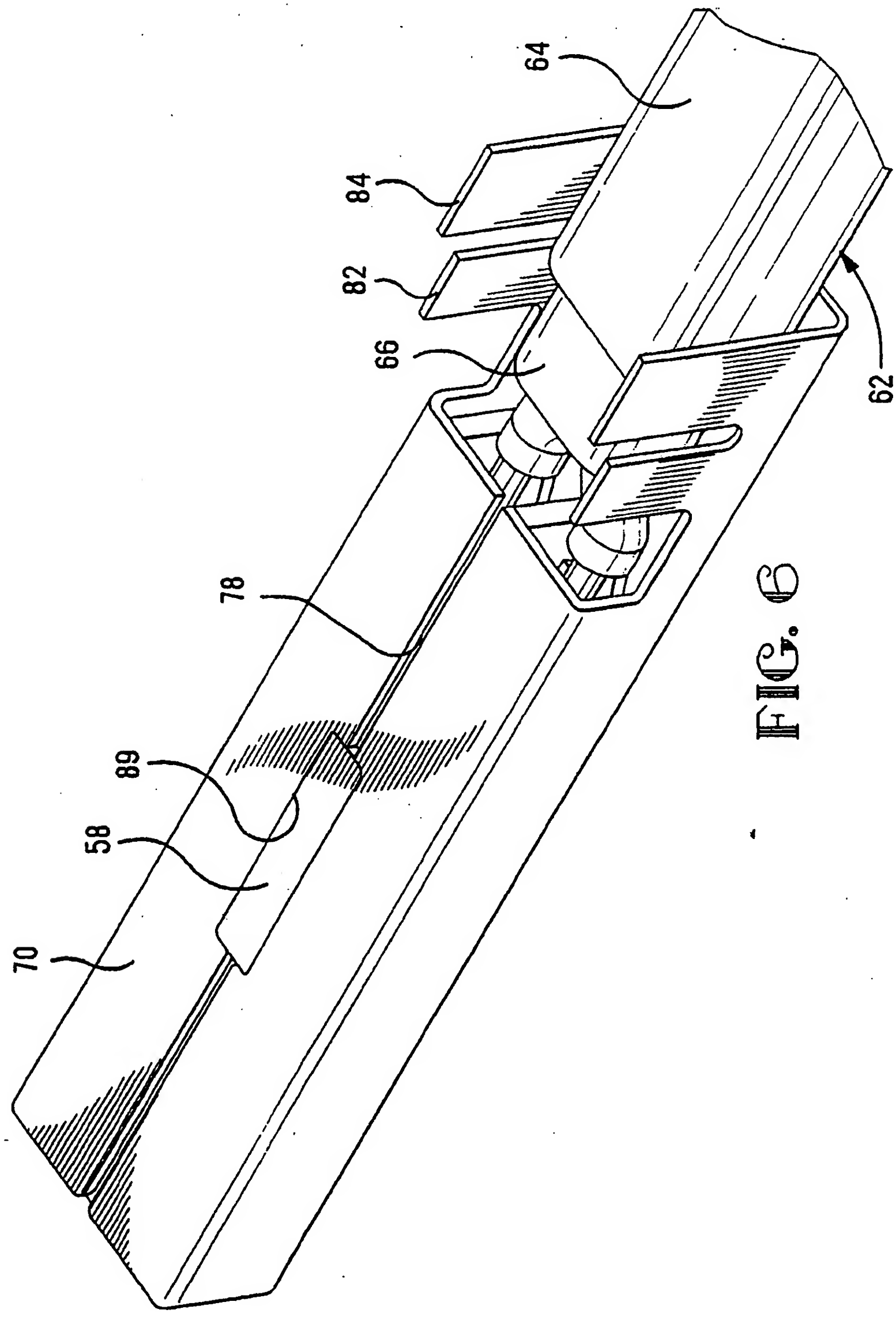

FIG. 6

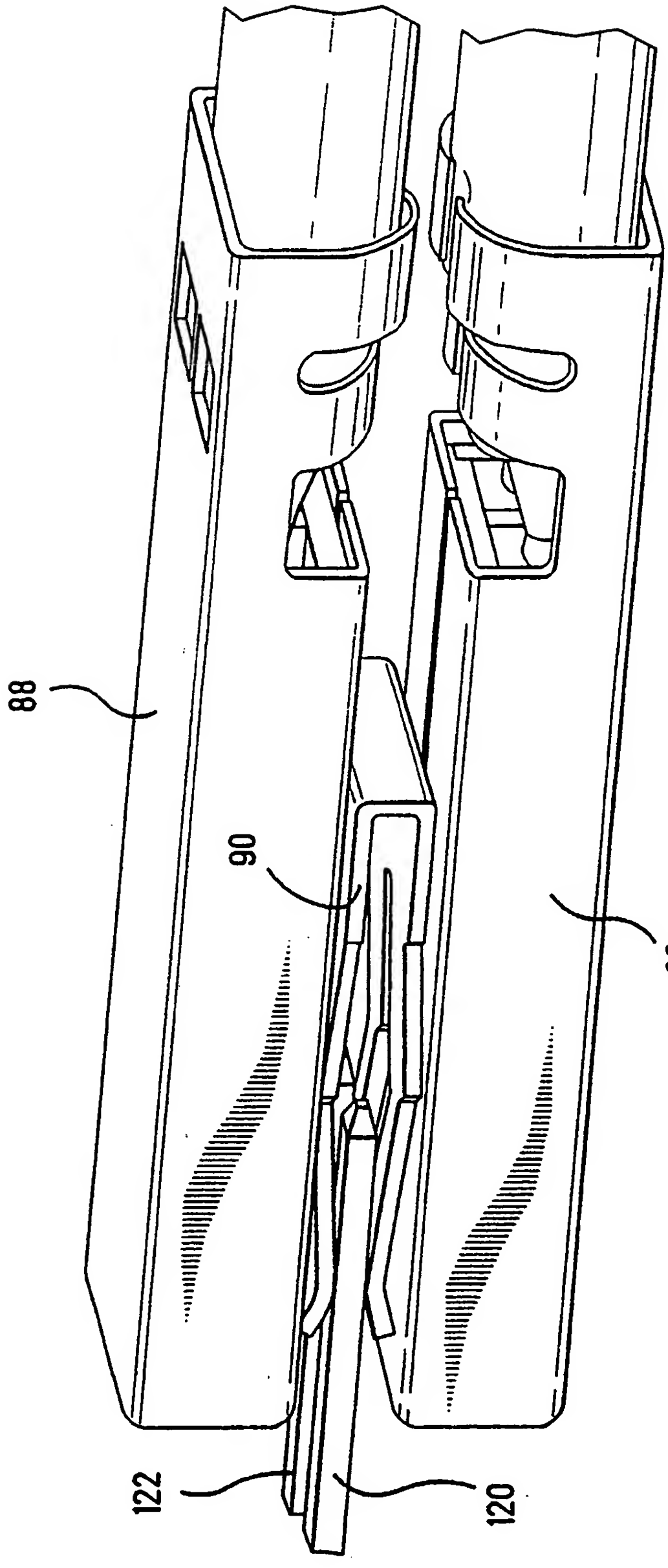

FIG. 7

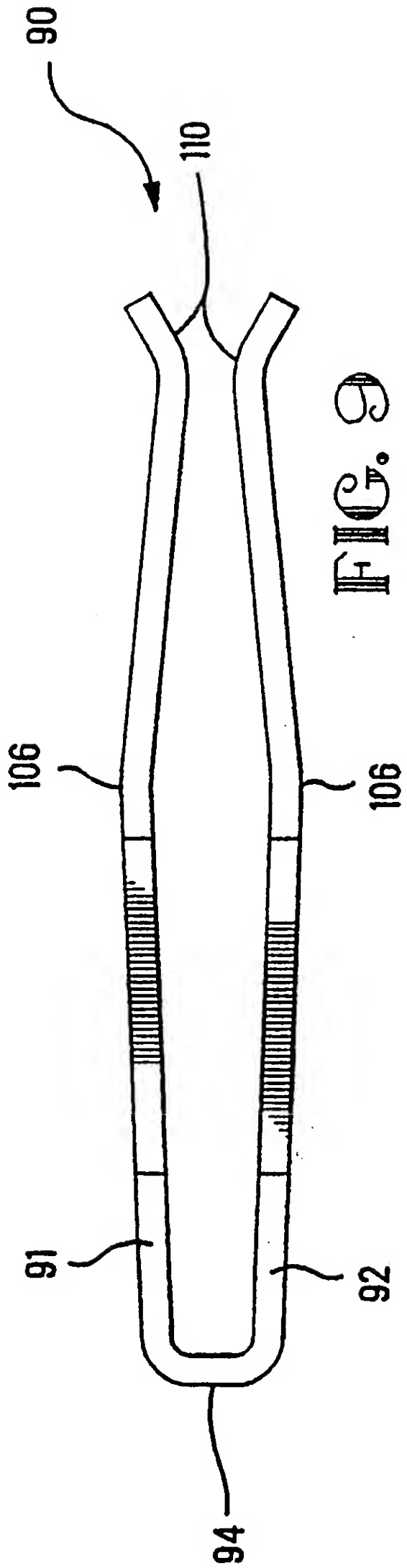

FIG. 9

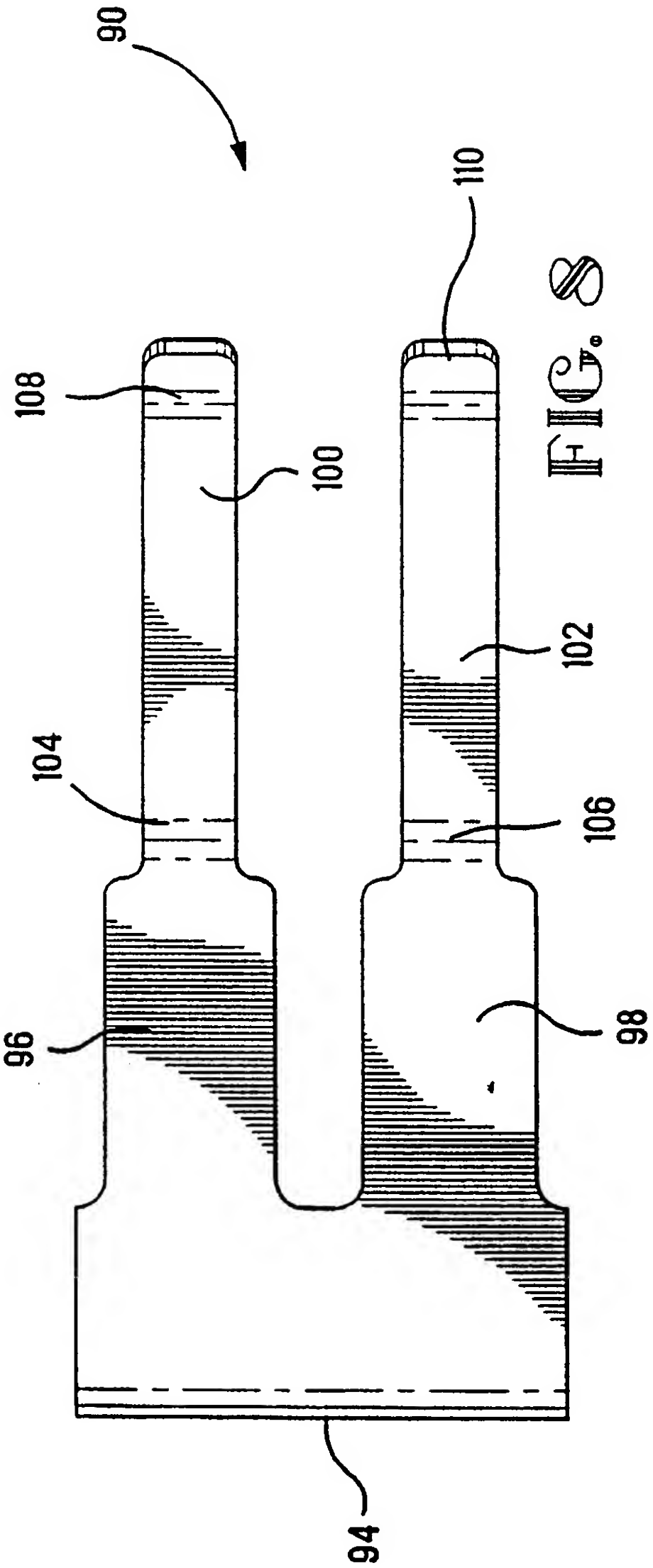

FIG. 10

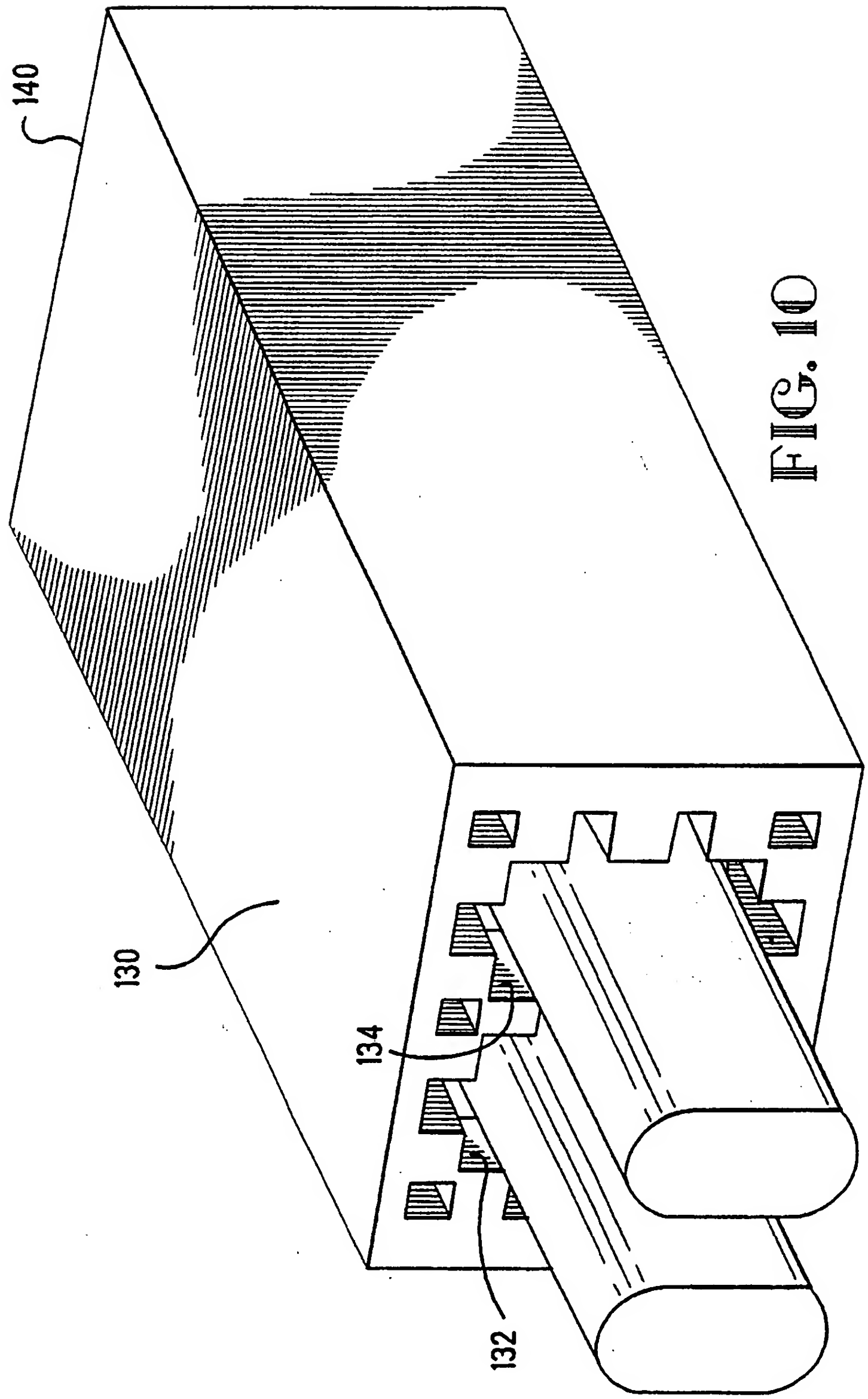

FIG. 16

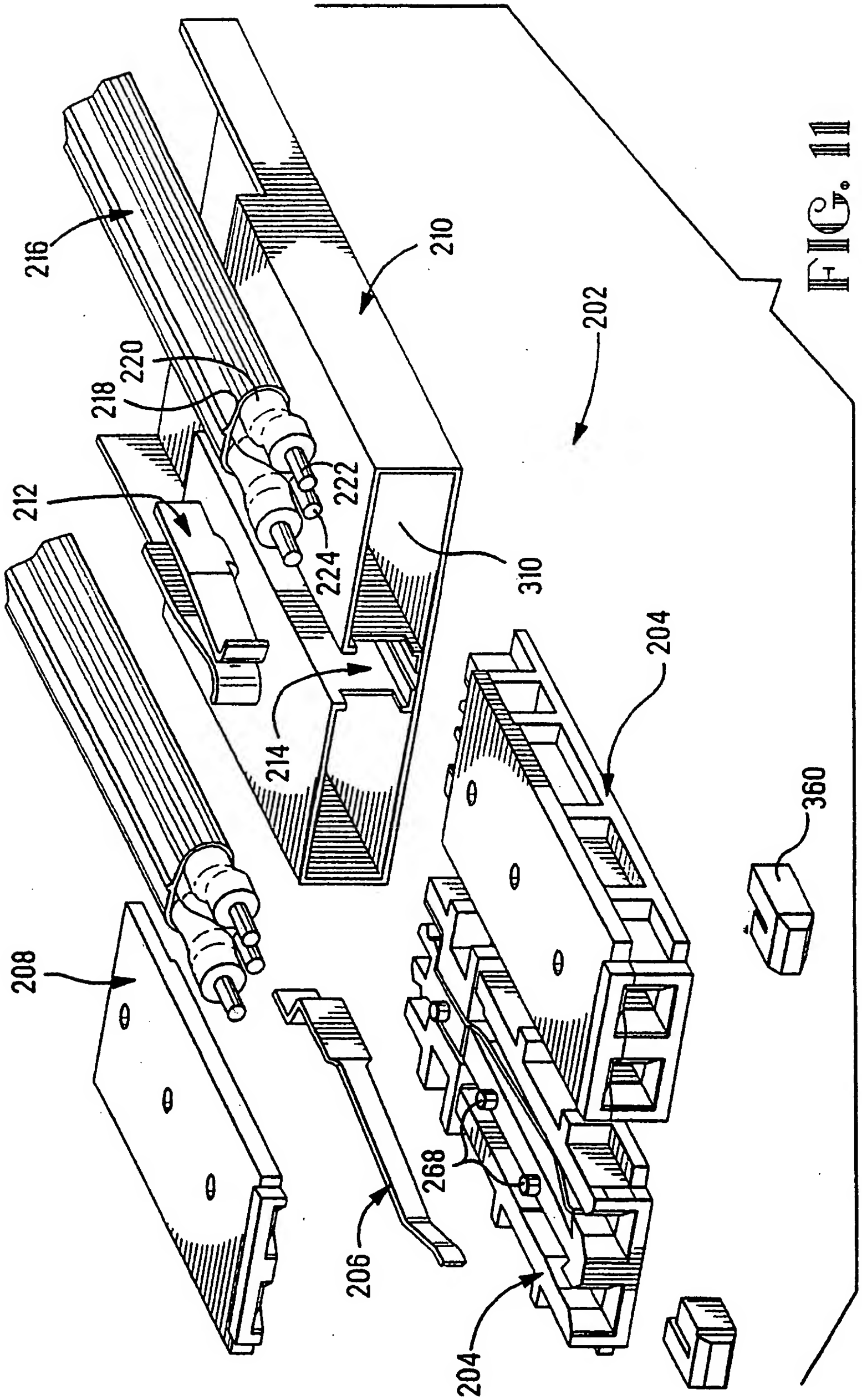

FIG. 11

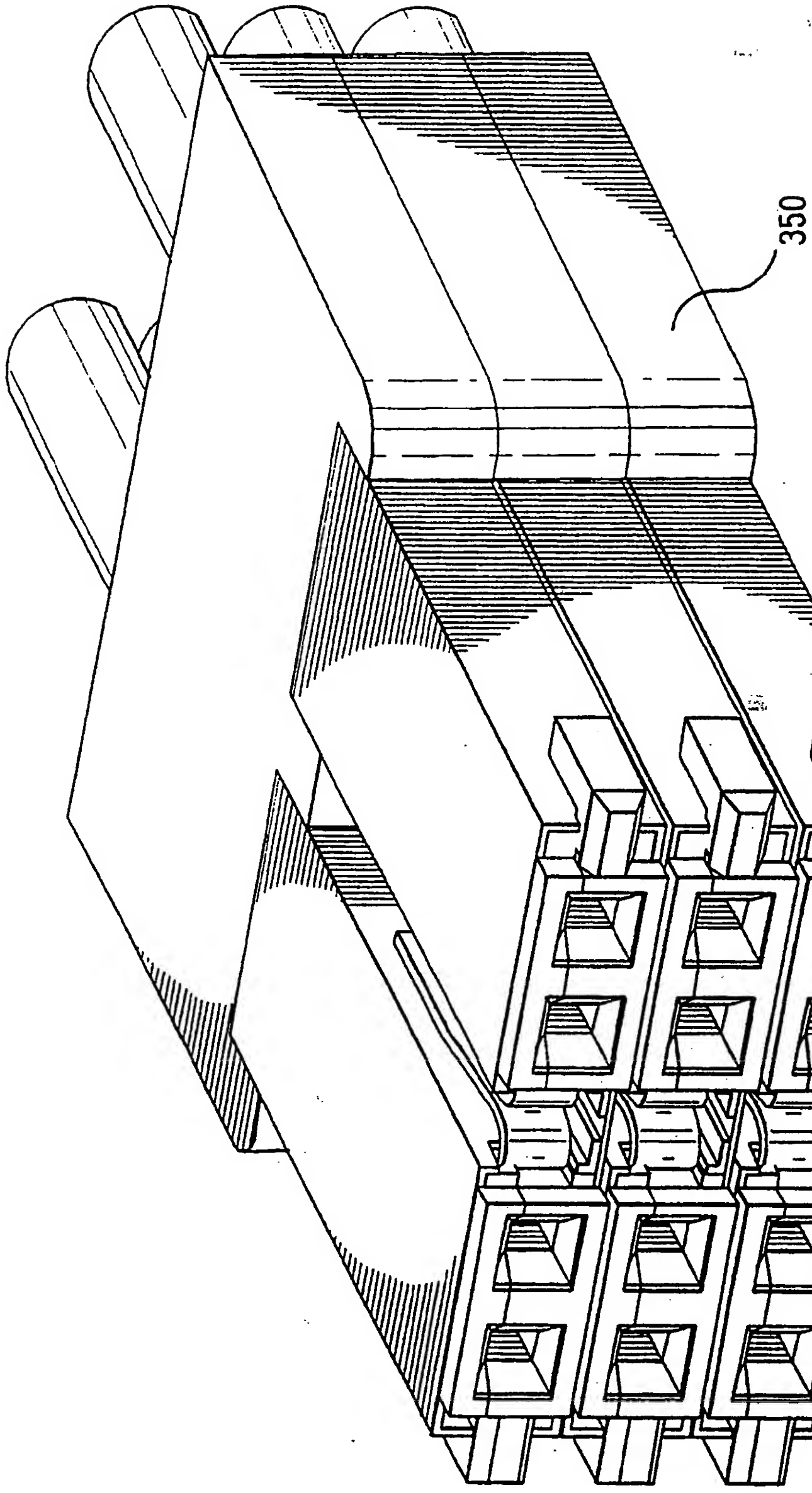

FIG. 12

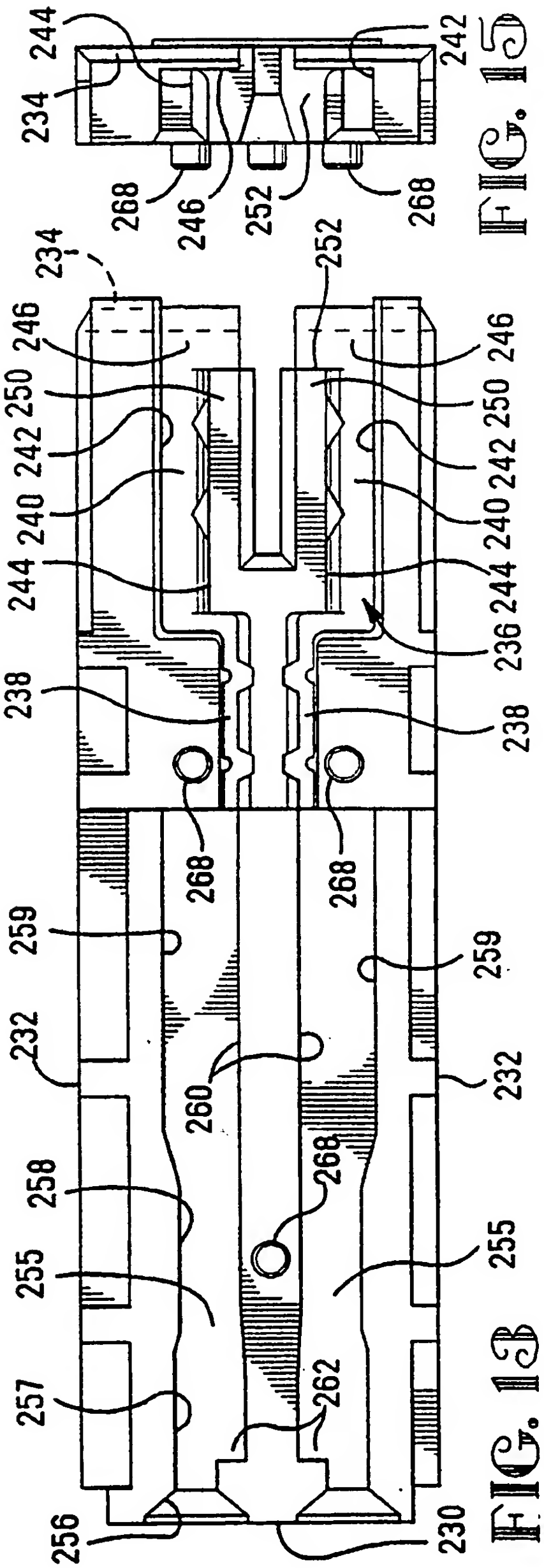

FIG. 15

FIG. 13

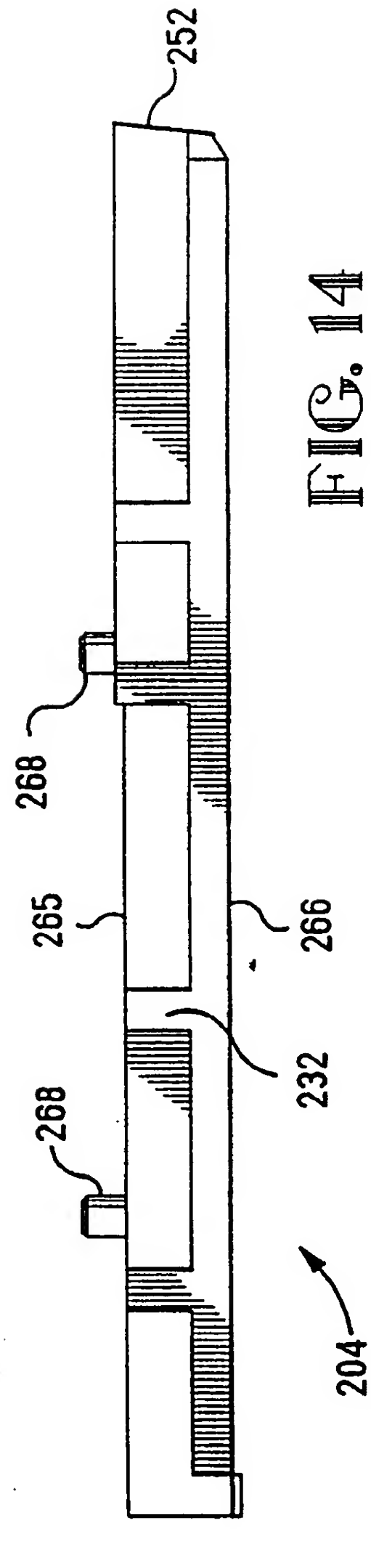

FIG. 14

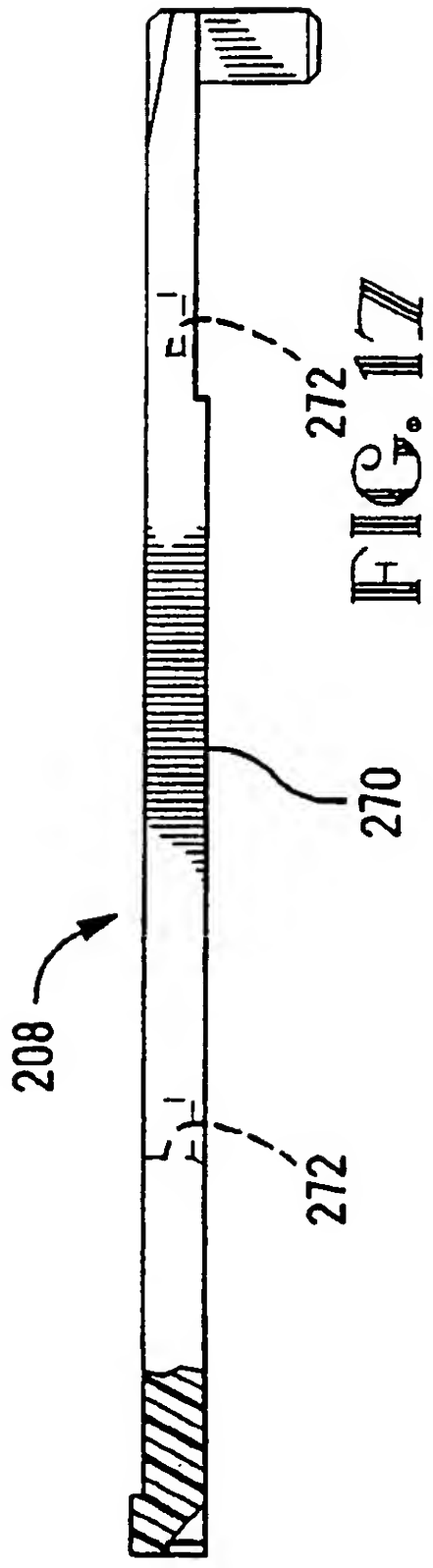

FIG. 17

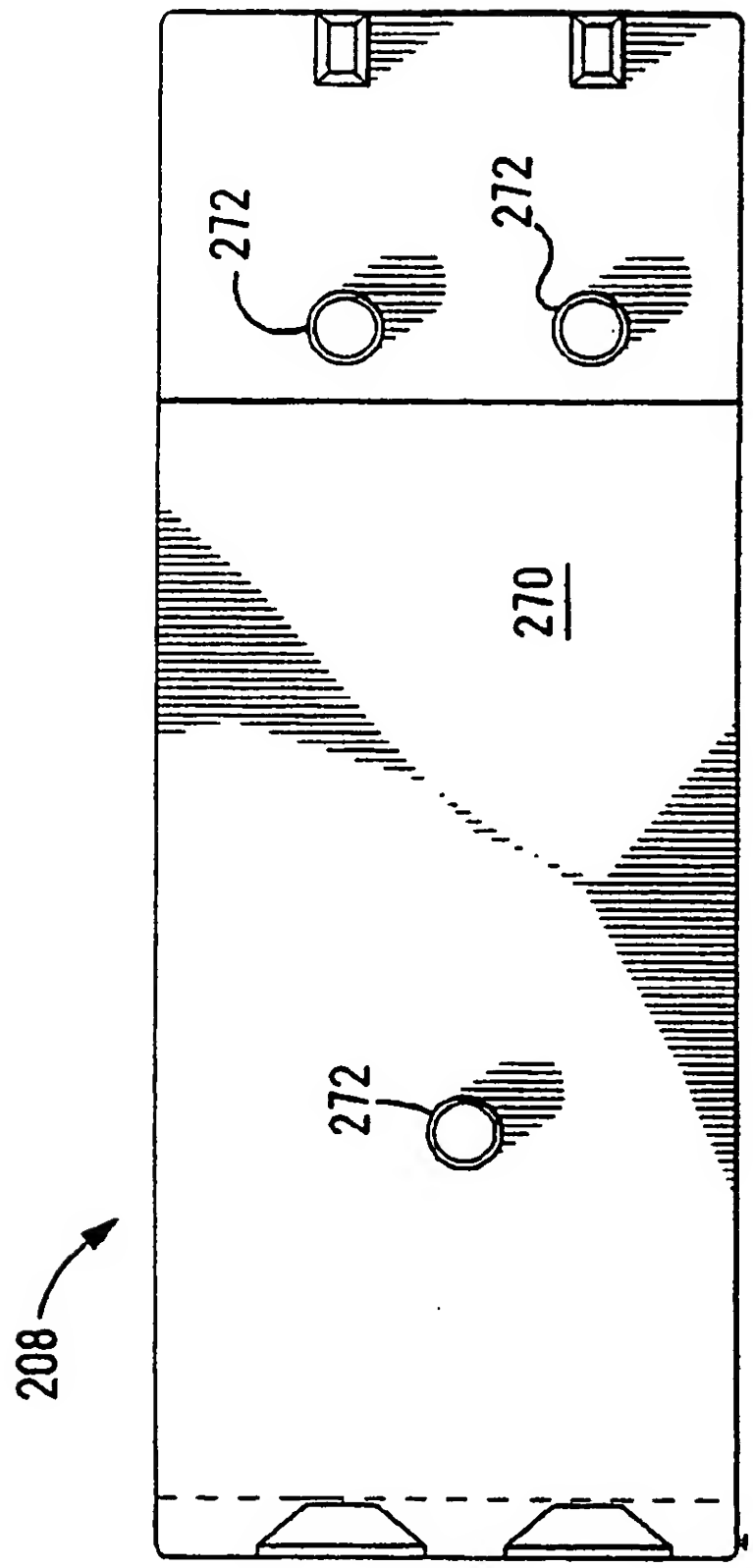

FIG. 16

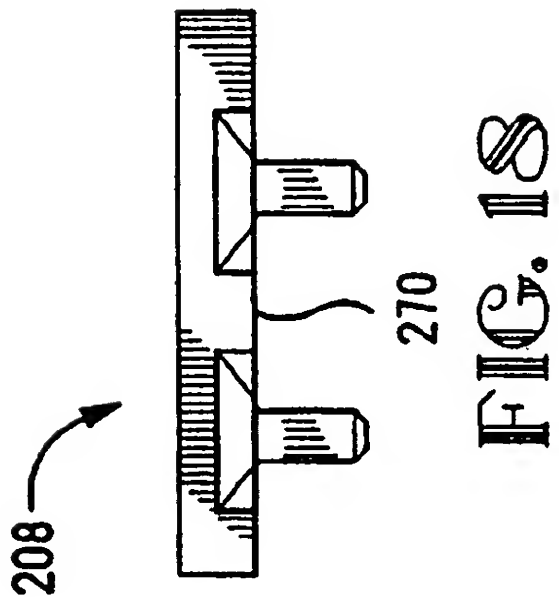

FIG. 18

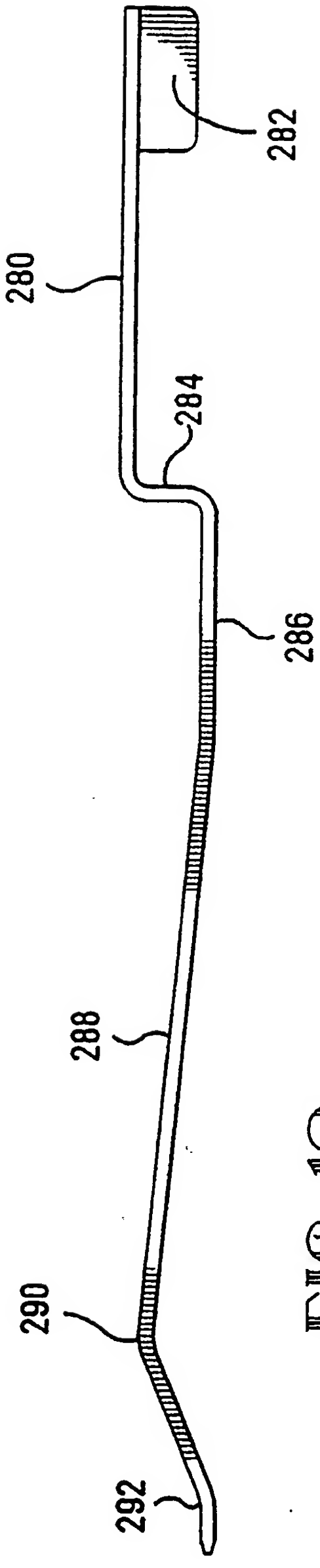

FIG. 19

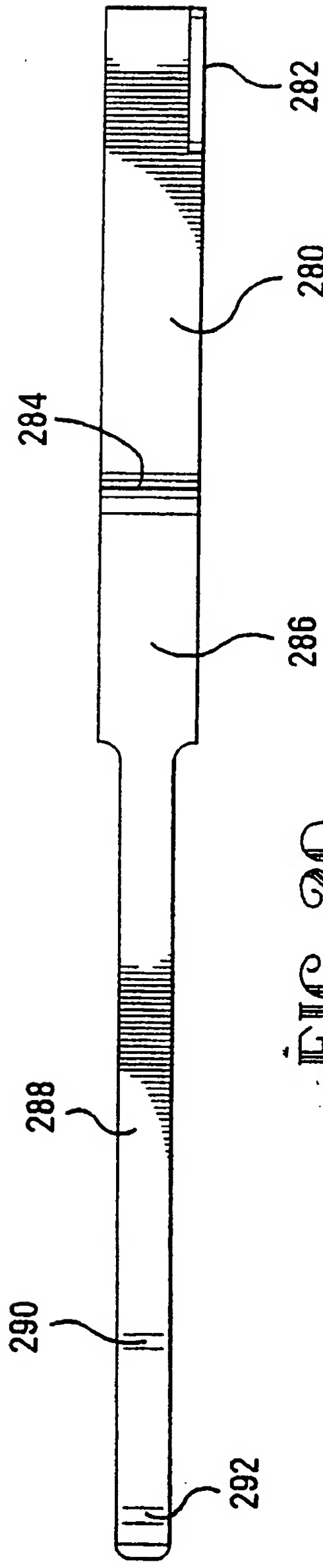

FIG. 20

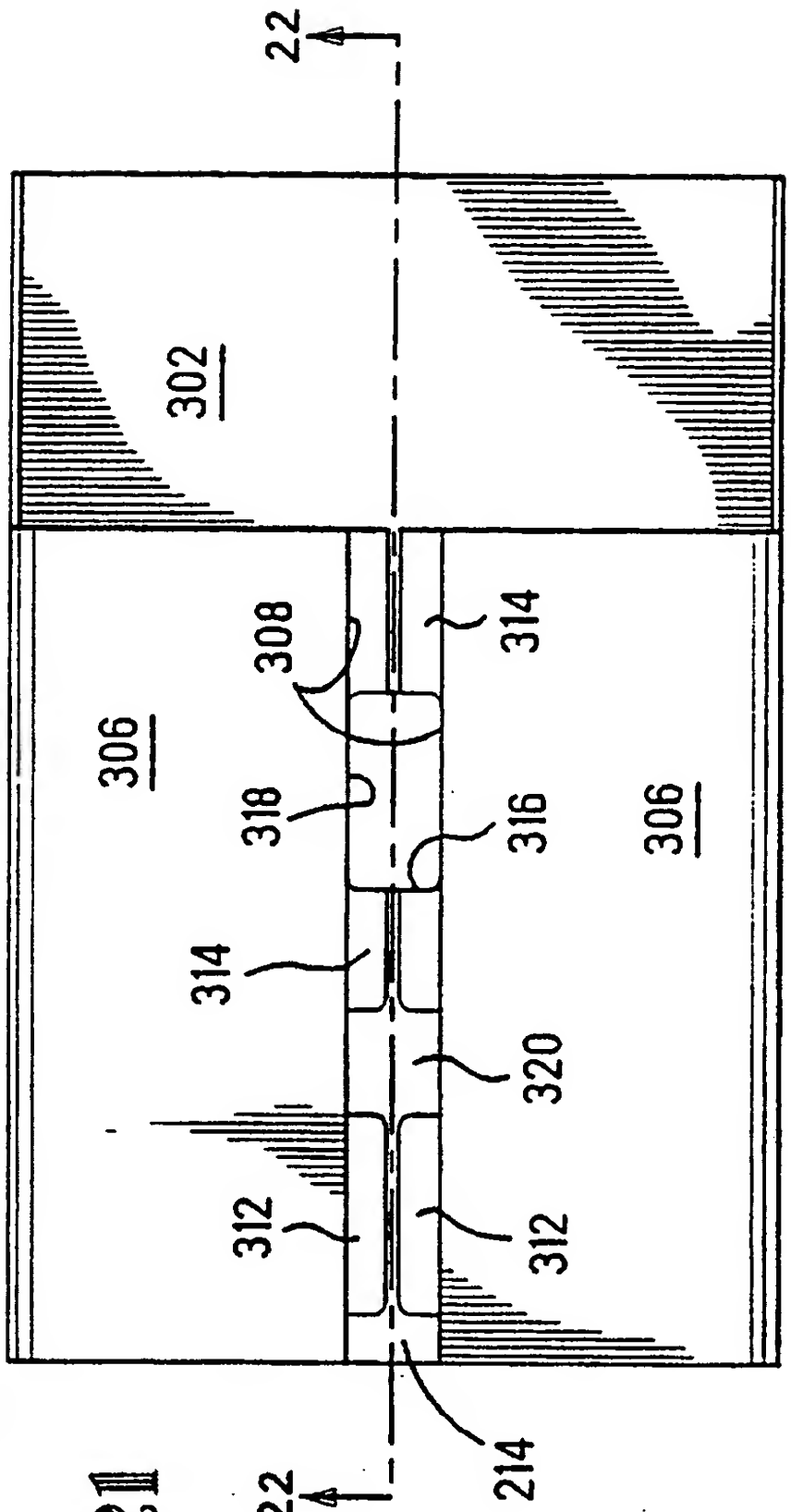

FIG. 21

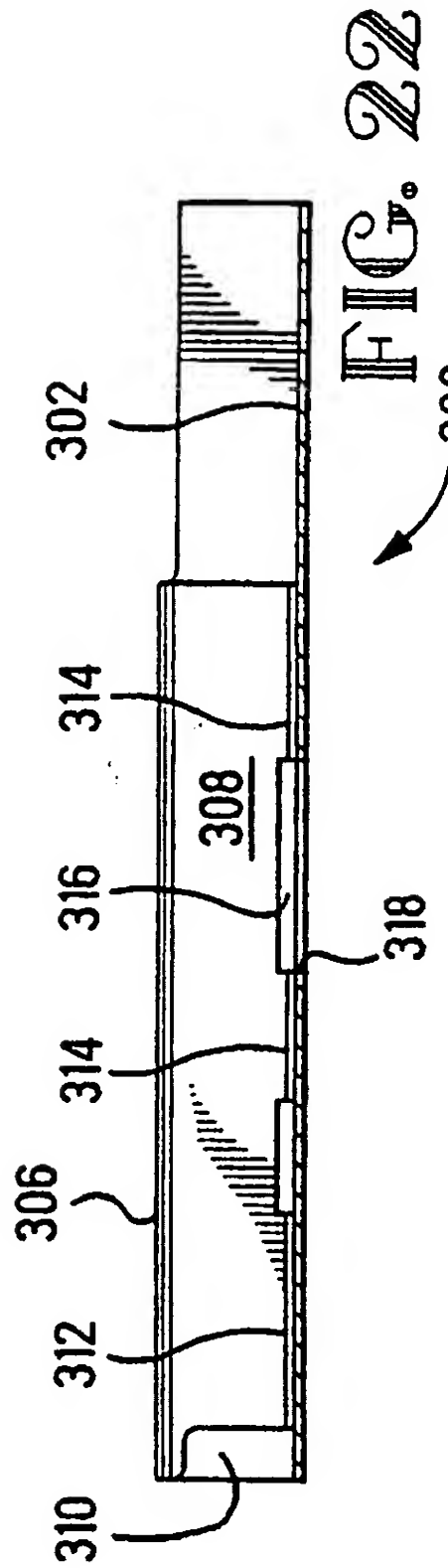

FIG. 22

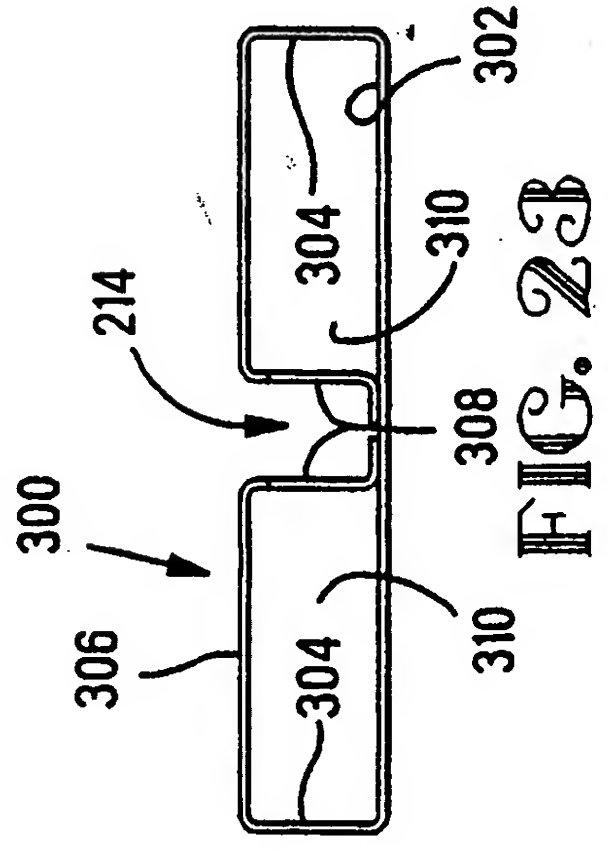

FIG. 23

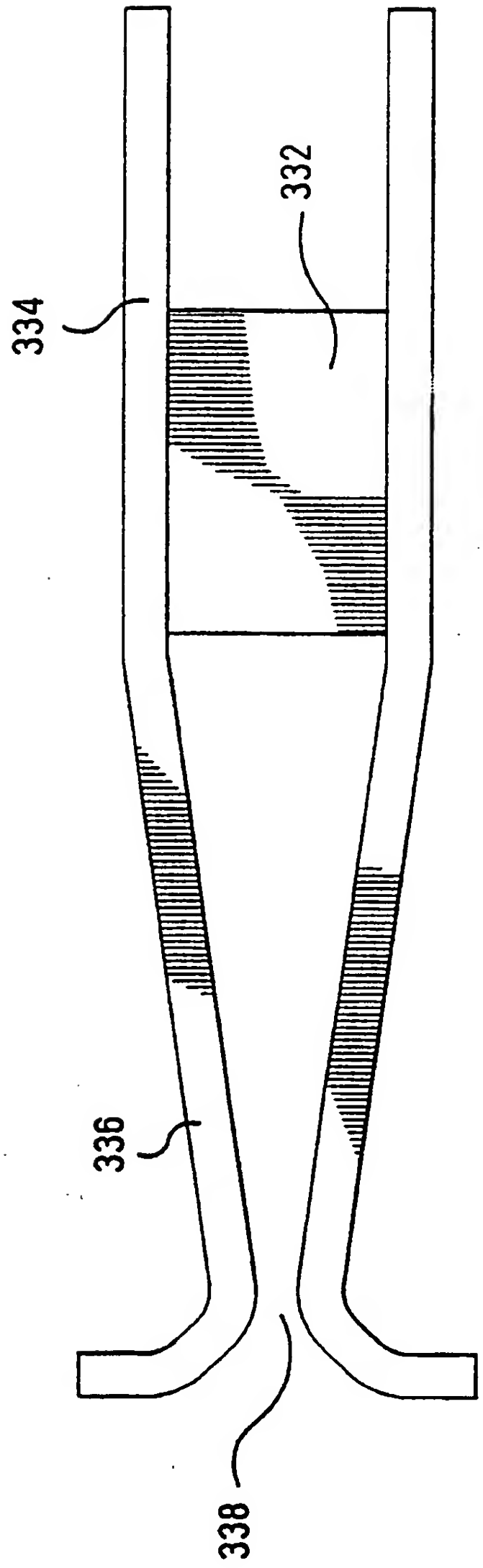

FIG. 24

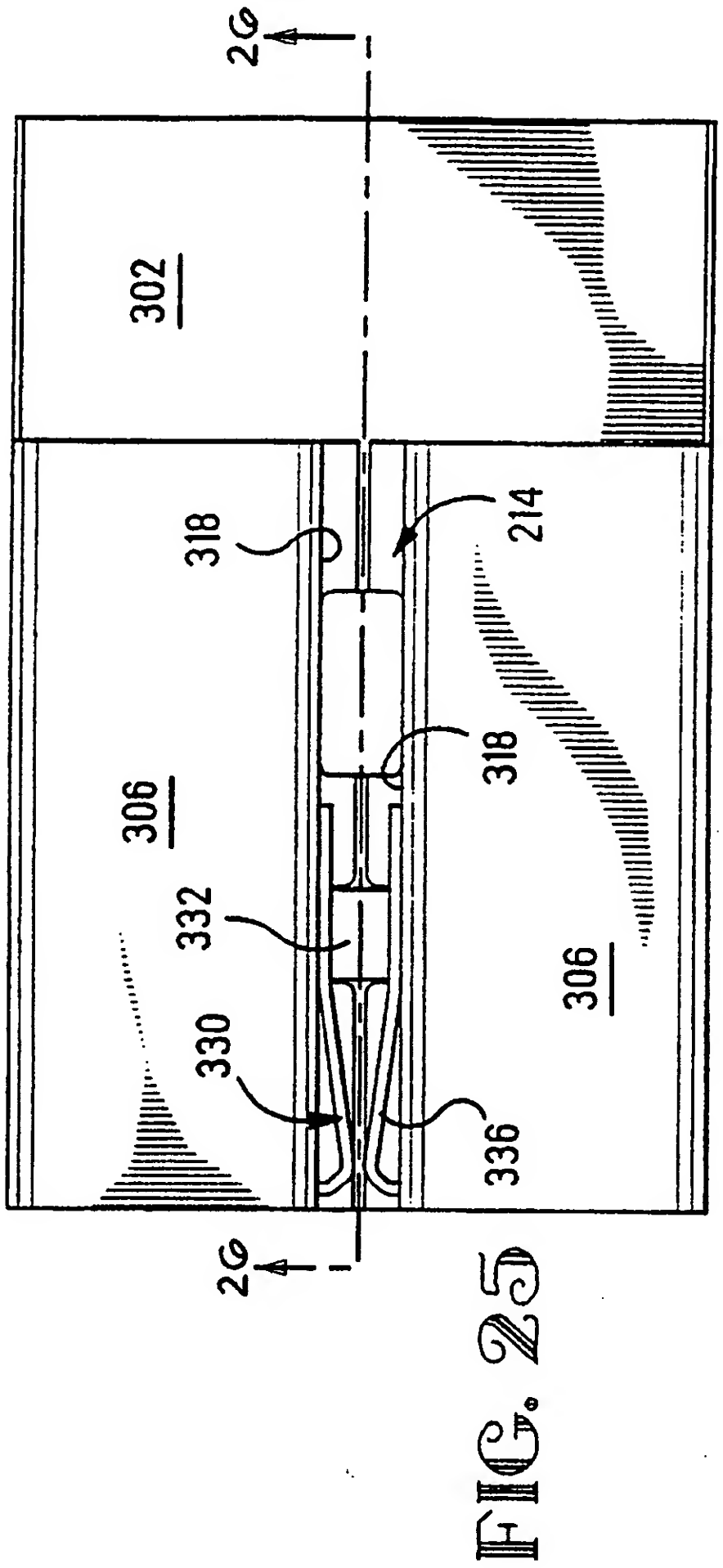

FIG. 25

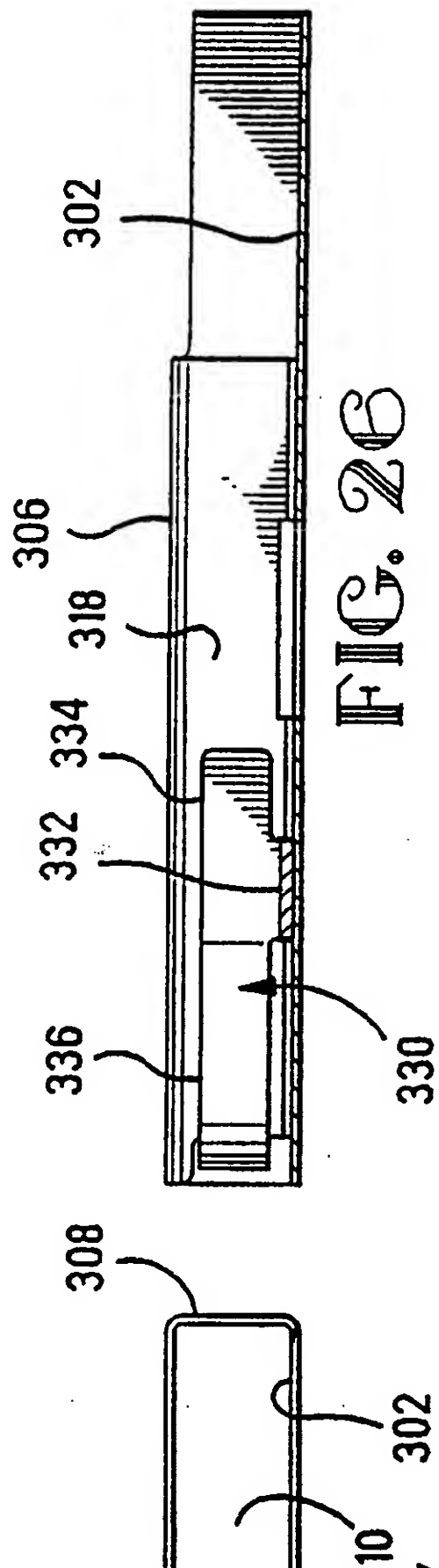

FIG. 26

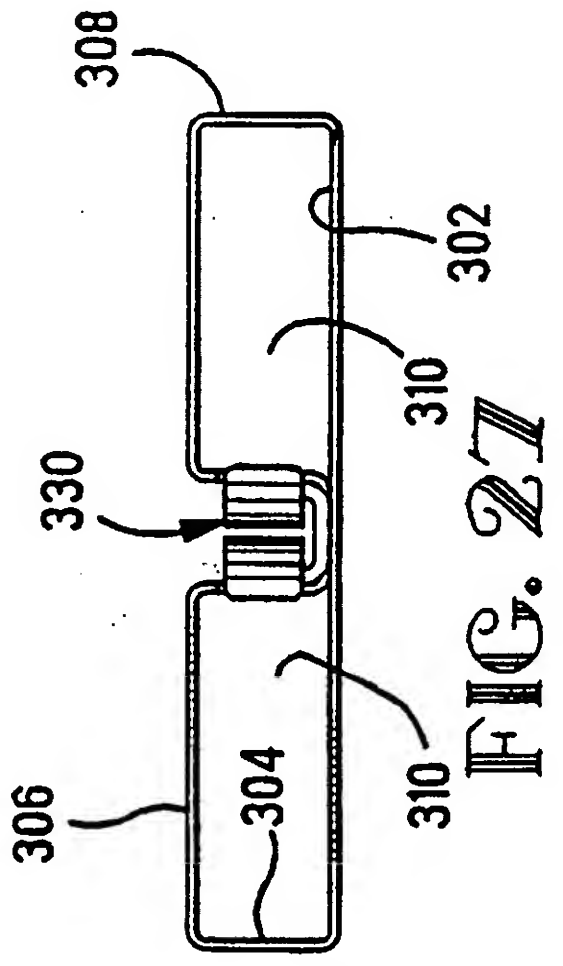

FIG. 27

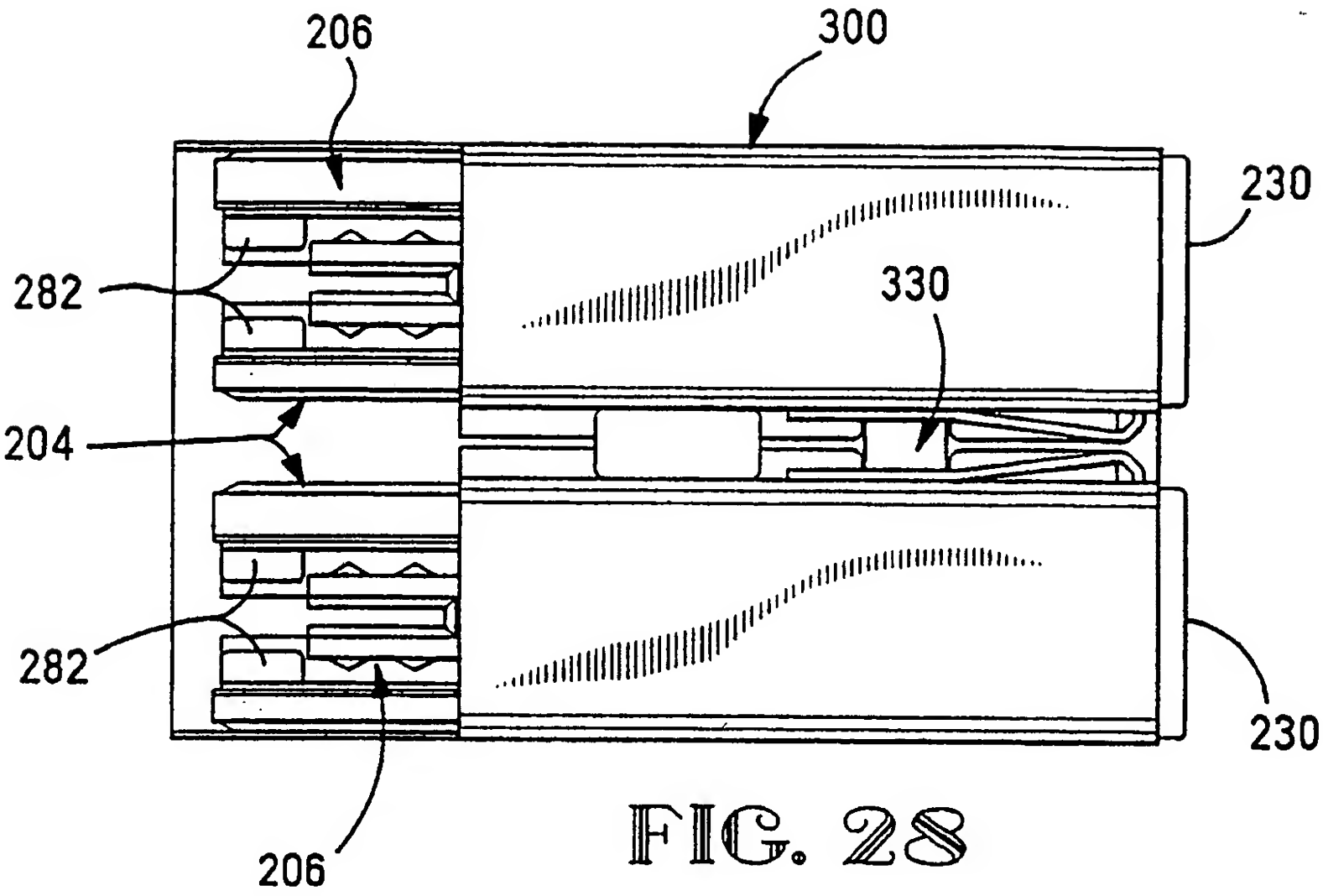

FIG. 28

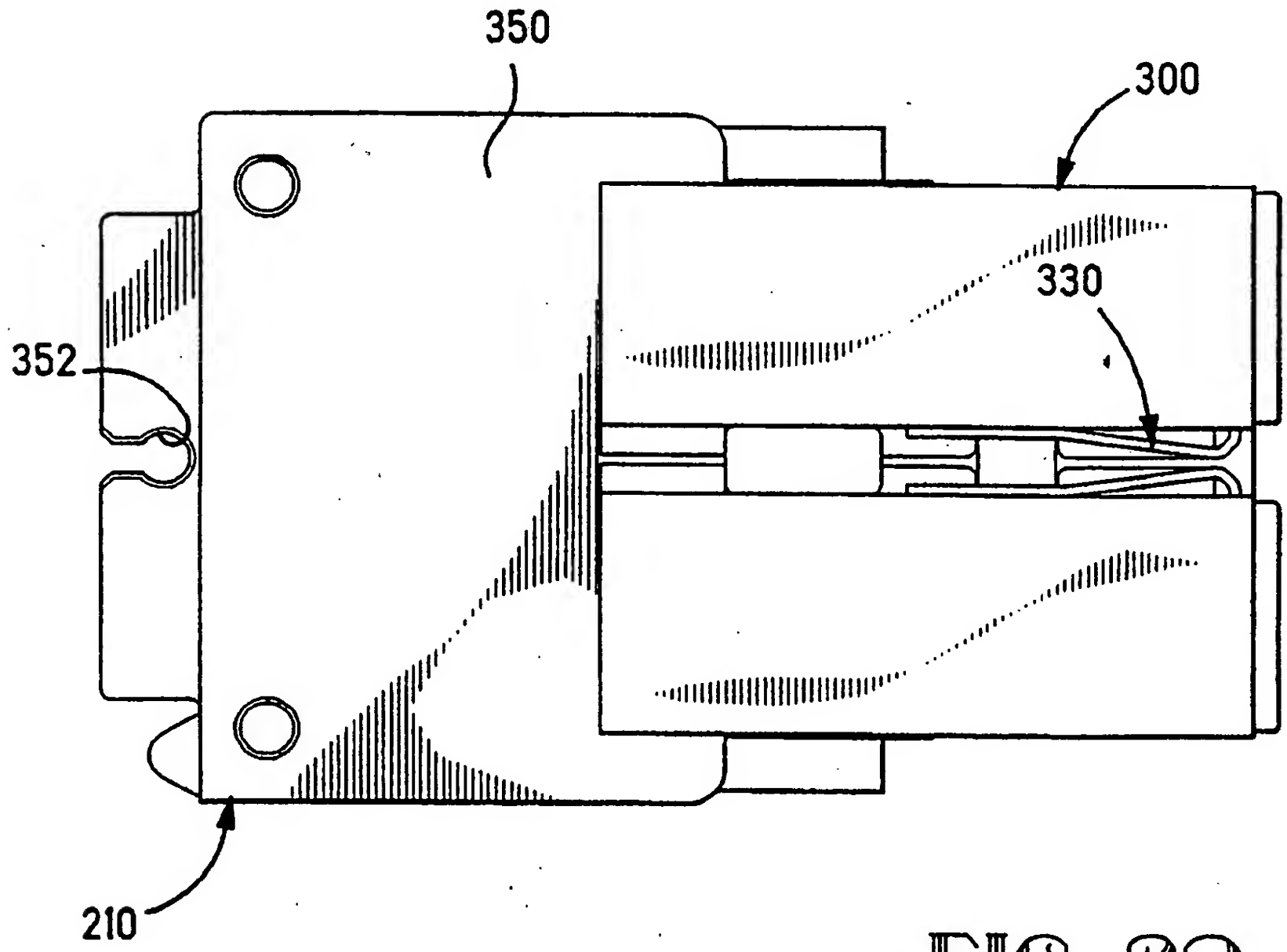

FIG. 29

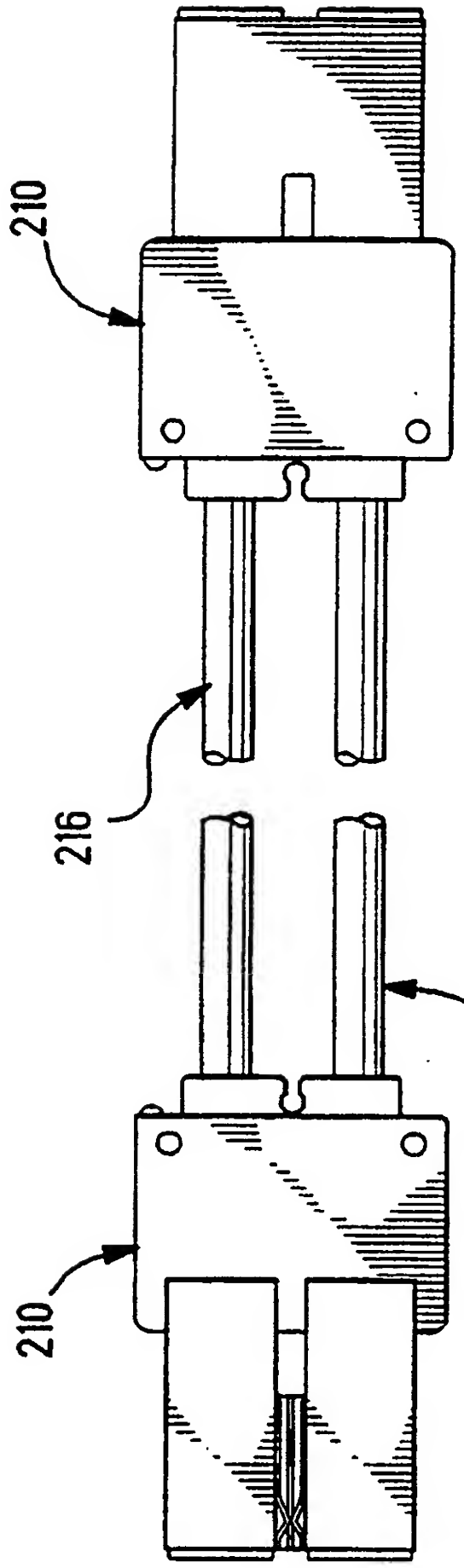

FIG. 80

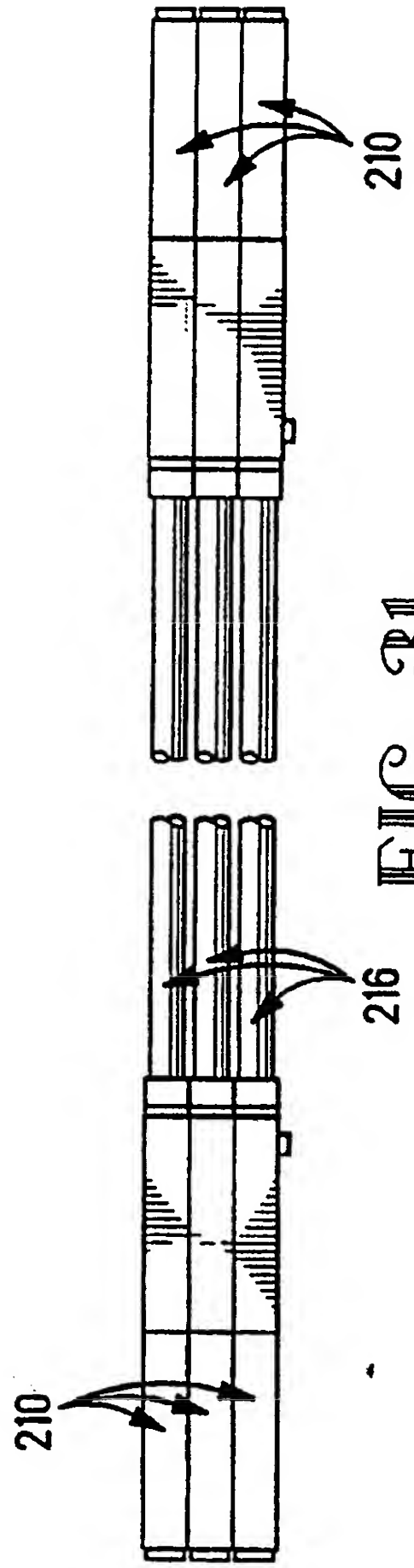

FIG. 81

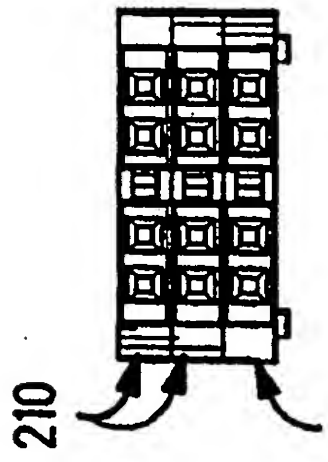

FIG. 82